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OUR CONTRIBUTORS

Dr. Shantz is physiologist in charge of physiological investigations of the Bureau of Plant Industry, U. S. Department of Agriculture. He has worked over much of the western part of the United States both in connection with that department and with the U. S. Geological Survey in its land classification work. During 1919 and 1920 he traveled extensively in Africa as agricultural explorer of the Department of Agriculture and crossed the continent from Cape Town to Cairo, when, in addition to other work he made a special study of native agriculture. He is joint author of a vegetation map of the United States soon to be published by the Department of Agriculture and of vegetation and land classification maps of Africa to be published shortly by the American Geographical Society.

Dr. Mather is professor of geology in Denison University. His work has been largely in the field of petroleum geology. In 1919–1920 he was engaged in reconnaissance work of this nature in Bolivia and Argentina. To the January number of the *Review* he contributed "Exploration in the Land of the Yuracarés, Eastern Bolivia."

Dr. Griffith Taylor, formerly Physiographer in the Commonwealth of Australia Bureau of Meteorology, Melbourne, is now associate professor of geography in the University of Sydney, N. S. W. He has distinguished himself by his fruitful application of climatology to the problems of settlement and human adaptation to environment in general. His main publications in this field are: "The Control of Settlement by Humidity and Temperature, (with Special Reference to Australia and the Empire): An Introduction to Comparative Climatology" (*Commonwealth Bur. of Meteorol. Bull. No. 14*, 1916; see *Geogr. Rev.*, Vol. 4, 1917, pp. 401–403, and Vol. 5, 1918, p. 85); "The Australian Environment, Especially as Controlled by Rainfall" (*Commonwealth Advisory Council of Science and Industry Memoir No. 1*, 1918); "The Climatic Control of Australian Production" (*Commonwealth Bur. of Meteorol. Bull. No. 11*, 1915, see *Geogr. Rev.*, Vol. 1, 1916, p. 396); "Geographical Factors Controlling the Settlement of Tropical Australia" (*Queensland Geogr. Journ.*, Vols. 32–33, 1918; reprinted in abridged form in the *Review*, Vol. 8, 1919); "Climatic Cycles and Evolution" (*Geogr. Rev.*, Vol. 8, 1919); "The Evolution and Distribution of Race, Culture, and Language" (*Geogr. Rev.*, Vol. 11, 1921).

Mr. Reed, who has acted as meteorologist to the U. S. Department of Agriculture and the U. S. Weather Bureau, served as captain and later major in the Signal Corps of the American Expeditionary Force. He has written largely on meteorological and climatological subjects, including rainfall in California and the problem of frost and frost protection. He is joint author of the article "Weather as a Business Risk in Farming" (*Geogr. Rev.*, Vol. 2, 1916).

Professor McAdie was for many years professor of meteorology in the U. S. Weather Bureau in charge of the stations in California, until resigning to become director of the Blue Hill Observatory and professor of meteorology at Harvard University. He has specialized in aerography, the science of the structure of the atmosphere. Among his numerous publications are: "Principles of Aërography" (Chicago, 1917); "Climatology of California" (Weather Bureau, Washington, D. C., 1903); "Rainfall of California" (Univ. of California, Berkeley, Cal., 1914); and several articles in the *Geographical Review*.

Mr. Reeve is a mechanical engineer. In addition to technical studies he has written on broad economic and social aspects of his field. He is author of "The Cost of Competition" (1906) and "Modern Economic Tendencies" (1919). To the *Geographical Review* he contributed the article "Congestion in Cities" (Vol. 3, 1917).

Mr. Gregg during the war was staff officer of the Shipping Section of the General Staff and later acted as adviser on shipping matters for the American International Corporation. He is now Chief of the Transportation Division of the Bureau of Foreign and Domestic Commerce.

Mr. Joerg is editor of the Research Series of the American Geographical Society.

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URUNDI, TERRITORY AND PEOPLE *

By H. L. SHANTZ
Bureau of Plant Industry, U. S. Department of Agriculture

Among the territories that have come into prominence as a result of the disposition of Germany's former colonial possessions none are possessed of a greater intrinsic interest than Ruanda and Urundi, the northwestern corner of late German East Africa. The climate is healthful, the scenery beautiful, the native population exceptionally numerous, intelligent, and industrious, the soil fertile, the natural resources varied and abundant. These regions are described by all travelers who have passed through them as lands flowing with milk and honey. And in fact this is true in the literal as well as the metaphorical sense. The writer will here record some of his observations in regard to Urundi, the more southerly of the two territories.

EARLY EXPLORATION OF URUNDI

Burton and Speke came near the borders of "inhospitable Urundi" but did not enter the country.[1] Livingstone and Stanley passed along its Tanganyikan shores in 1871. In 1879 two white fathers established a mission at Rumonge, which in consequence of a massacre by the Warundi was abandoned in 1881. Other missionaries entered, and another station was founded in Uzige (a district about Usumbura) in 1884 and shortly afterwards abandoned because of Arab hostility. Subsequently successful missions were established, and to one of the missionaries in particular, Burgt, we owe much of our knowledge of the people, their customs, and their industries.[2] The first European layman to enter Urundi was Dr. O.

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[1] R. F. Burton: The Lake Regions of Central Equatorial Africa, *Journ. Royal Geogr. Soc.*, Vol. 29, 1859, pp. 1–464; reference on pp. 251 *et seq.*

[2] J. M. M. van der Burgt: Dictionnaire français-kirundi, avec l'indication succincte de la signification swahili et allemande, Bois-le-Duc, Holland, 1903. This volume is an encyclopedia as well as a dictionary. See also *idem;* Land und Leute von Nordurundi (Deutsch-Ostafrika), *Petermanns Mitt.*, Vol. 58, II, 1912, pp. 324–327 and Pl. 53.

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Baumann in 1892.[3] Since then a number of scientists, most of them German, have traversed portions of the country[4] and the adjacent and largely similar territory of Ruanda.[5]

Boundaries and Area

The boundaries of the old German province are somewhat indefinite. It is separated from Ruanda on the north by the Akanyaru River and an indefinite line extending from its headwaters across and down a small river to the Rusizi River which drains Lake Kivu into Lake Tanganyika. The Rusizi River and Lake Tanganyika form the western boundary. At about 45 kilometers north of Kigoma the southern boundary runs east until it reaches the headwaters of the Mlagarasi River, which it follows in a northeasterly direction until the river turns sharply to the south. The boundary then extends northward in an irregular line until it reaches the Ruvuvu River, crosses to the Akanyaru, follows it a short distance, and turns west across the northern edges of Lakes Rugwero and Shohoho. According to German and British maps the area enclosed in Urundi is about 11,768 square miles; or, if we include an uncertain area to the northwest (above the dotted line on the sketch map, Fig. 1), it amounts to 12,298 square miles.[6]

Topography and Drainage

Urundi as a whole is a mountainous plateau, a section of the high plateau land between Lake Tanganyika and Lake Victoria. It drops steeply some 3,000 feet on the western side to the shore of Lake Tanganyika and the bottom of the Rusizi valley, a part of the great western *Graben* or rift, of Central Africa. A few small isolated plains lie between the shore and the foot of the plateau slope. From the shore plains the edge of the plateau

[3] Oscar Baumann: Die kartographischen Ergebnisse der Massai-Expedition des Deutschen Antisklaverei-Comités, *Petermanns Mitt. Ergänzungsheft No. 111*, 1894; *idem:* Durch Massailand zur Nilquelle. Reisen und Forschungen der Massai-Expedition des deutschen Antisklaverei-Komite in den Jahren 1891–1893, Berlin, 1894.

[4] Richard Kandt: Bericht über meine Reisen und gesammte Thätigkeit in Deutsch-Ostafrika, *Mitt. aus den Deutschen Schutzgebieten*, Vol. 13, 1900, pp. 240–264; *idem:* Caput Nili, Berlin, 1904; Hans Meyer: Ergebnisse einer Reise durch das Zwischenseengebiet Ostafrikas 1911, *Mitt. aus den Deutschen Schutzgebieten Ergänzungsheft No. 6*, 1913; Hans von Ramsay: Uha, Urundi und Ruanda, *Mitt. aus den Deutschen Schutzgebieten*, Vol. 10, 1897, pp. 177–181; G. F. Scott Elliot: A Naturalist in Mid-Africa, London, 1896. And see the bibliography to German East Africa in Hans Meyer: Das Deutsche Kolonialreich, Leipzig and Vienna, 1909–10, Vol. 1, pp. 407–416.

[5] Adolphus Frederick, Duke of Mecklenburg: In the Heart of Africa, transl. by G. E. Maberly-Oppler, London, New York, etc., 1910; G. A. von Götzen: Durch Afrika von Ost nach West, Berlin, 1895; Sir Alfred Sharpe: The Backbone of Africa (1920), reviewed elsewhere in this number of the *Review;* Jan Czekanowski: Forschungen im Nil-Kongo-Zwischengebiet, Vol. 3, Ethnographisch-Anthropologischer Atlas (Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907–1908 unter Führung Adolf Friedrichs, Herzogs zu Mecklenburg, Vol. 7), Leipzig, 1911; Capt. E. M. Jack: The Mufumbiro Mountains, *Geogr. Journ.*, Vol. 41, 1913, pp. 532–550.

[6] Paul Sprigade and Max Moisel: Grosser Deutscher Kolonialatlas, Berlin, 1901–12; Ruanda and Urundi, Africa in 1:1,000,000, *Geographical Section, General Staff, Map No. 2932*, War Office, London, 1919; [British] Report on Tanganyika Territory, covering the period from the conclusion of the Armistice to the end of 1920, Cmd. 1428, H. M. Stationery office, London, 1921.

Burgt, who lived in Urundi and who is responsible for the best topographic map of the northern part of the country (scale 1:200,000, Pl. 53 accompanying "Land und Leute von Nordurundi," *Petermanns Mitt.*, Vol. 58, II, 1912, pp. 324–327), does not show the dotted border line (Fig. 1).

is seen as a series of rounded and weathered hills, the slopes ranging from 10° to 35° and seldom showing rock outcrops. The lake shore strip and the

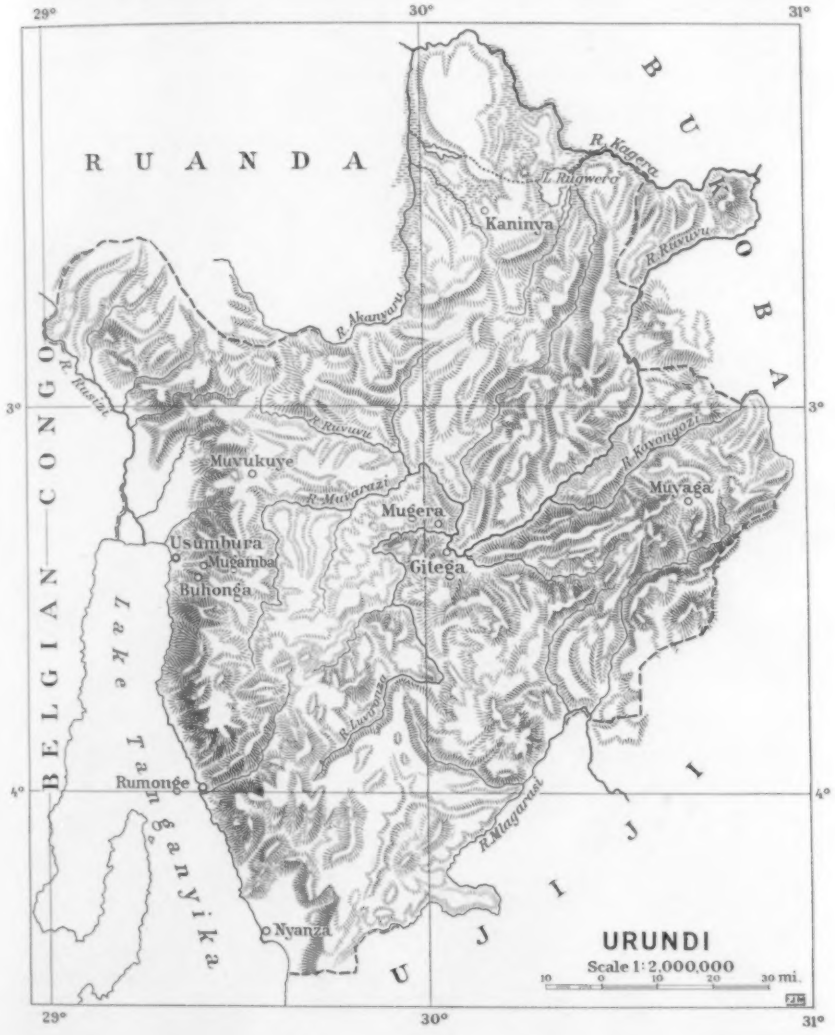

FIG. 1

lower valley of the Rusizi River are the lowest part of the country, the elevations here ranging from 2,500 to 3,400 feet. The western edge of the plateau (Randberge) rises to heights of over 8,000 feet, and the hilly upland that constitutes the rest of the country and descends gradually to the lower Victorian plateau averages between 4,500 and 6,000 feet above sea level.

The surface is everywhere thoroughly and deeply, but not sharply, dissected. The valley slopes are steep, ranging to 35°, but they are nowhere precipitous. The watershed ridges are unequal and differ in height from place to place on the same ridge. The inequalities on each ridge are in the form of evenly or smoothly rounded knobs, none of the profiles giving a serrate outline. All of the surfaces are smoothly rounded.

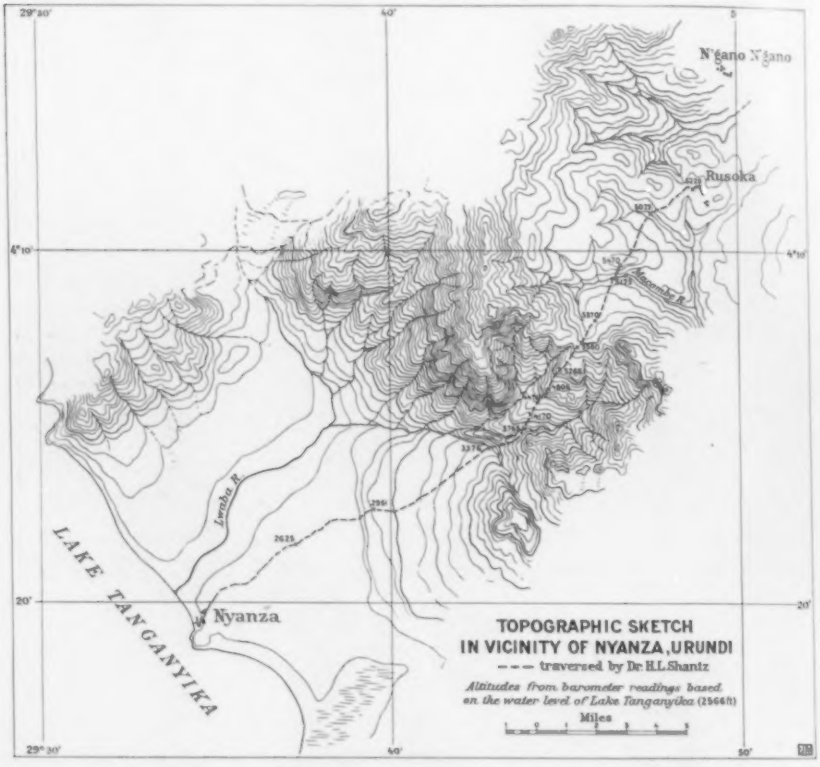

FIG. 2—Sketch map of a portion of southwestern Urundi. Scale approximately 1:350,000.

The rivers are still cutting down their beds, and the valleys are usually narrow. In the northeast, however, they flow through sluggish papyrus swamps. The drainage to the west is limited to a series of small streams which head in the edge of the plateau above the east shore of the lake. A small area in the southeast drains into the Mlagarasi, which swings south and west and empties into Tanganyika about 30 miles south of Ujiji. The drainage to the Congo thus constitutes about 38 per cent of the land area, Nile drainage constituting the remaining 62 per cent. The Nile-Congo watershed is marked in the north by the western portion of the mountainous plateau which runs parallel to the Rift Valley. In southern

Urundi it lies along a smoothly rounded area of high land, varying from about 5,700 to 6,500 feet in elevation, lying in a line drawn from Nyanza to Muyaga. While the Nyavarongo of Ruanda, a head stream of the Kagera, is now considered the source of the Nile,[7] some of the Urundi streams have also been claimants for this honor.[8] From Lake Victoria to the headwaters of the Muvarazi or Luvironza, tributaries of the Ruvuvu, is about 400 miles as compared with 430 to the headwaters of the Nyavarongo. The distance from the headwaters of the Ruvuvu to the mouth of the Nile is approximately 4,000 miles, while that from the headwaters of the Mlagarasi to the mouth of the Congo is about 2,300 miles.

FIG. 3—The more rugged portion of the western edge of the highland. Here there is a less smoothly rounded topography, but there are still no cliffs or precipices. The slopes are as great as 35° in places. A remnant of the temperate rain forest is shown in the center of the photograph. Over most of the areas are mountain grasses. Photograph looking north at about 5,265 feet elevation.

CLIMATE

The most notable feature of the climate is the modification of temperature with altitude. Actual records, however, are very meager. According to De Greef[9] Gitega in the Ruvuvu valley at about 5,250 feet elevation showed an extreme range of from 61° to 79° F. (16°–26° C.) during the dry period, July 27 to August 19 (1918?), the minimum ranging from 61° to 65° F. (16° to 18.5° C.), and the maximum from 74° to 79° F. (23.5° to 26° C.). For the wet season, November 25 to December 15, the extreme range was from 54° to 79° F. (12° to 26° C.). The temperature of the region on the shore of Tanganyika is higher than in the upland. During the period

[7] Kandt, Caput Nili.

[8] Baumann, Durch Massailand zur Nilquelle.

[9] G. De Greef: Monographie agricole de la région de l'Urundi, ancienne province de l'Afrique orientale allemande, *Bull. Agric. du Congo Belge*, Vol. 10, 1919, pp. 3-69; reference on p. 10.

February 25 to March 21, 1920, inclusive, the temperature at Nyanza ranged from 65° to 86° F. (18.3° to 29.5° C.). The extreme range at Usumbura in 1912[10] was from 58° to 97° F. (14.3° to 36° C.). The rainfall is less abundant than in Ruanda, and there is a marked dry season. In general the dry season may be said to extend from June to October and the rainy season from November to May. The heaviest rains come in March and April. December is comparatively dry. In the lowlands drought affects the pasturage during the dry season, but in the mountains it is often green the year round.

Usumbura on the lake shore has an average rainfall (8 years) of 34 inches. The rainy season, November to April, is credited with a rainfall of 27.5 inches, the dry season, June to September, with 1 inch.[11]

TABLE I—RAINFALL RECORDS OF MISSION STATIONS[12]

STATION	ELEVATION	LENGTH OF RECORD IN YEARS	AMOUNT OF RAINFALL IN INCHES
Kaninya (northern)	4,900	5	39
Mugera (central)	5,700	4	40
Muyaga (eastern)	5,200	3	41

SOILS

The soils of the mountain region are for the most part reddish loams or clays relatively uniform in color at different depths. Analysis of samples shows, contrary to what might be expected, that this is not an old lateritic soil but a younger soil, although the rainfall of about 40 inches has leached it of most of its soluble matter. It is, however, capable of producing excellent crops. In places erosion has removed almost all of the surface soil. Such crests show a deep brick-red color and can be seen for many miles. In fact, in the upland region about N'gano N'gano areas of red clay not covered by vegetation contrast sharply with the grass-covered hills.

The soil samples collected have been analyzed by the Bureau of Soils; and Dr. C. F. Marbut, Chief of the Soil Survey, gives the following discussion of the results.

The soil from the top of the plateau, No. 28,856, was taken from the surface foot, and No. 28,857 from 18 inches below the surface. The soil is a clay loam in texture with a low percentage of free quartz in fragments large enough for identification by the unaided eye. A considerable part of the silica present is combined silica and without much doubt is present in the form of aluminum silicate. The percentage of iron oxide is high, as well as that of alumina and combined water, the latter indicated by the rather high loss of igni-

[10] P. Heidke: Meteorologische Beobachtungen aus Deutsch-Ostafrika, Part IX, *Mitt. aus den Deutschen Schutzgebieten*, Vol. 27, 1914, pp. 85–188; reference on p. 103.

[11] H. G. Lyons: Climatological Studies—German East Africa, *Quart. Journ. Royal Meteorol. Soc.*, No. 182. Vol. 43, 1917, pp. 175–196; ref. on p. 193.

[12] Heinrich Schnee, edit.: Deutsches Kolonial-Lexicon, Leipzig, 1920, Vol. 3, p. 287

tion. Part of this loss is due to organic matter but, on account of the small amount of the latter, not more than 3.5 to 4 per cent: the greater part of this loss consists of combined water.

A small amount of the water is combined with the iron, but the greater part is probably combined with the alumina, and the amount of both water and alumina is strongly suggestive of the presence of a small percentage of aluminum hydroxide. This is indicative in its turn of the operation of lateritic weathering in this region, the high rainfall of about 40 inches tending to confirm such a conclusion.

The low percentage of alkalies and alkaline earths indicates extensive leaching also. The soil corresponds in composition quite well with the red soils of the Piedmont regions of Georgia and Alabama. It is a good grass soil but under intensive cropping would require fertilization for best results.

TABLE II—CHEMICAL ANALYSES OF SOILS COLLECTED NEAR RUSOKA AT ABOUT 5,100 FEET ELEVATION

ANALYSIS FOR	SOIL NO. 28,856	SOIL NO. 28,857
Silica, SiO_2	44.73	45.46
Titanium dioxide, TiO_2	1.43	1.57
Ferric oxide, Fe_2O_3	13.66	12.60
Alumina, Al_2O_3	26.89	25.35
Manganese oxide, MnO	0.21	0.44
Lime, CaO	0.05	0.39
Magnesia, MgO	0.28	0.46
Potash, K_2O	0.51	0.47
Soda, Na_2O	trace	trace
Phosphorus pentoxide, P_2O_5	0.21	0.33
Sulphur trioxide, SO_3	0.03	0.05
Nitrogen, N	0.08	0.14
Ignition loss,	12.15	13.21
Moisture,	2.895	3.18
Carbon dioxide, CO_2	0.00	0.00

Soil No. 28,856—High Urundi, 1 foot.
Soil No. 28,857—Under 28,856, 1½–2 feet.

On the lowlands, along the river bottoms, and on the narrow plain along the shore of Tanganyika the soil is rich deep alluvium, often sandy and darker in color. It produces excellent crops.

VEGETATION

On a broad basis there are only four types of vegetation of importance in Urundi. First from the standpoint of area and usefulness is the *mountain grass*. It forms a great prairie occupying all of the land at higher elevations with the exception of relatively small patches of temperate rain forest. It consists of a rather dense growth of grasses usually from two to three feet high and constituting a continuous cover. The area is well supplied with rain for most of the year, and the grasses afford practically continuous

FIG. 4

FIG. 5

FIG. 4—Looking toward the top of the western edge of the plateau from an elevation of nearly 3,765 feet. All the ridges and crests are smoothly rounded, and the slopes vary in steepness. The highest point in this photograph rises a very short distance into the clouds. The vegetation is grassland with a few scattered trees, not confined to the water course but occurring anywhere either on the sides or crests of the hills.

FIG. 5—The plain bordering Lake Tanganyika at Nyanza, looking across the valley of the Lwaba River. Tanganyika is seen as a white band in the background at the left, the mountain north of Nyanza in the center, and the western edge of the plateau at the right. The vegetation in the foreground consists of Andropogon-like grasses, Crotalaria, and Borassus palms. In the lowland there are coarse grasses such as Sorghum. On the slopes of the mountains trees such as Acacia become prominent in the grassland. The many banana plantations and cornfields are not distinguishable from the natural vegetation.

left, the mountain north of Nyanza in the center, and the western edge of the plateau at the right. [illegible] Crotalaria, and Borassus palms. In the lowland there are coarse grasses such as Sorghum. On the slopes of the mountains trees such as Acacia become prominent in the grassland. The many banana plantations and cornfields are not distinguishable from the natural vegetation.

FIG. 6

FIG. 7

FIG. 6—A general view over a smoothly rounded portion of the mountainous grass-covered plateau. About one-tenth of the grassland has been utilized for the production of bananas and other crops. The grove of trees (mostly Ficus) marks the *boma* of the sub-chief, Rusoka. About the *boma* are plantations of banana and fields of sorghum, elusine, beans, corn, sweet potato, etc. At the left are the huts of the Wahutu who serve the chief. The hill at the right is somewhat eroded, and the red soil shows through the grass cover. Looking east across Rusoka at 5,225 feet elevation.

FIG. 7—The plain on which Nyanza is located is shown at the extreme right. Grass-covered hills rise above the plain forming the western edge of the plateau. Photograph taken below 3,765 feet elevation.

fresh pasture, than which it would be difficult to find a finer anywhere. This type of vegetation occurs at high elevations about the great lakes and is especially extensive in Abyssinia. It occurs also on the mountains of Tanganyika Territory and in Kenya Colony, where it constitutes part of the "rangatan," or prairies of the high plateau, described by J. W. Gregory.[13]

Botanically the grasses have not been extensively studied. At N'gano N'gano the grassland is composed chiefly of the following species:[14]

Hyparrhenia filipendula (Hochst.) Stapf, one of the most important grasses of this highland and excellent for grazing.
Trichopteryx sp., one of the most important grasses, grown on the hills and 1–2 feet high.
Sporobolus pyramidalis Beauv., one of the important grasses, dominant on the lower slopes and grazed by cattle.
Ctenium concinnum Nees, one of the important grasses.
Eragrostis cilianensis (All.) Link, relatively important, limited on the drier slopes.
Eragrostis chalcantha Trin., " " " " " " "
Microchloa indica (L.) Kuntze, very abundant on hilltops but small and not a noticeable feature on the grassland.
Themeda triandra Forsk., a relatively important grass, although by no means of primary importance.
Hyparrhenia rufa (Nees) Stapf.
Digitaria argyrotichia (Anderss.) Chiov.
Aristida sp.
Tricholaena rosea Nees.
Eragrostis sp., a ruderal.
Eragrostis collocarpa Schum., a semi-ruderal of some importance.

The mountain grass furnishes practically the only food for the great herds of cattle. Although the country is densely populated, most of the land is left in the natural sod. In the region visited by the writer only about ten per cent was under cultivation.

Temperate Rain Forest

The temperate rain forest of Urundi is now limited to two small areas, one northeast of Rumonge and another northeast of Usumbura, and to many small patches on steep or sheltered slopes naturally protected from destruction by primitive man or by fire or preserved as sacred groves. The great tall white trunks of the trees stand out and can be seen for miles. The principal trees of this type of forest noted by Mildbraed[15] in Ruanda, probably the same as in the Urundi forests, are *Olea hochstetteri* Baker, *Macaranga kilimandscharica* Pax, *Podocarpus milanjiana* Rendle, and *Hagenia abyssinica* J. F. Gmel. Meyer, who crossed Urundi from east to west and west to east, collected the following in the temperate forest: *Olea hochstetteri* Baker, *Macaranga kilimandscharica* Pax, and *Hagenia abyssinica* J. F. Gmel.[16] These small forest patches are remnants of the

[13] J. W. Gregory: The Great Rift Valley, London, 1896, p. 289.
[14] Identified by Agnes Chase.
[15] J. Mildbraed, edit.: Botanik (Wissenschaftliche Ergebnisse der Deutschen Zentral-Afrika-Expedition 1907–1908 unter Führung Adolf Friedrichs, Herzogs zu Mecklenburg, Vol. 2), Leipzig, 1914, p. 623.
[16] Hans Meyer: Ergebnisse einer Reise durch das Zwischenseengebiet Ostafrikas, 1911, *Mitt. aus den Deutschen Schutzgebieten Ergänzungsheft No. 6*, 1913, pp. 93–101.

FIG. 8

FIG. 9

FIG. 8—A general view over the plain at Nyanza taken from near the base of the mountains. It shows the tall grass with scattered trees. Typical acacia-tall grass country.

FIG. 9—The bank of the Lwaba near Nyanza. The coarse grasses are mostly Sorghum and Arundinaria Natives are here shown crossing the stream and filling the pots which they carry on their heads.

great temperate rain forest or yellowwood (Podocarpus) forest which dominates the high mountain forest land of East Africa. Formerly this forest must have been much more extensive. It has been invaded by the natives, seeking new land for agriculture and pasture.[17] Much of the mountain grassland would probably revert to forest were it not for the constant burning and grazing. A considerable use is made of the remaining forest: it furnishes clothing, utensils, and wood or fuel in the shape of bark cloth, wood, and charcoal.

Acacia-Tall Grass

This type occurs along the lowlands on the west and about the northern and eastern boundary lines. It consists of tall grasses three to five feet high, which do not form a sod but cover the ground much as does a cereal crop when sown broadcast. Scattered through this grassland either singly or in clumps are trees of moderate size, seldom over 30 to 40 feet high, often with flat, widespreading top, giving a landscape with a parklike or orchard-like appearance. The grasses are chiefly *Hyparrhenia filipendula* (Hochst.) Stapf, *Themeda triandra* Forsk., and *Cymbopogon giganteus* (Hochst.) Stapf.

On the plain just back of the shore of Lake Tanganyika, palms form a conspicuous part of the vegetation. Borassus is quite abundant, and the oil palm, which has been planted throughout the grassland, has the appearance of being a part of the natural plant cover. Wood and bast fiber are secured here. The bast fiber is constantly used whenever string or rope is needed. The acacia-tall grass areas are not as well suited to cattle as are the mountain-grass areas, because of the poorer forage, long drought period, higher temperature, and greater prevalence of disease. Goats, cattle, and sheep are kept in this region. Tsetse fly occurs along the shore of Lake Tanganyika.[18] At Nyanza on the shore of Lake Tanganyika the Belgian officer had, however, an unusually fine herd of cattle that received excellent care.

Marsh Grass

Wherever water stands over the surface, as along the river bottoms of northern and eastern Urundi, the marsh-grass type of vegetation occurs. Here are luxuriant areas of papyrus (*Cyperus papyrus* L.), which is abundant in both the highlands and lowlands of equatorial Africa. Great areas of *Andropogon arundinaceus* (Willd.) Stapf occur on the alluvial land of the plains about Nyanza. Here also occur *Imperata cylindrica Thunbergii* Dut. & Shintz, *Phragmites communis* Trin., and other coarse grasses.

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[17] Compare C. H. Stigand: The Lost Forests of Africa, *Geogr. Journ.*, Vol. 45, 1915, pp. 513–520; and D. E. Hutchins: Report on the Forests of British East Africa, Cd. 4723, London, 1909.

[18] De Greef, *op. cit.*

Wild Animal Life

In contrast with conditions on the grassy steppes further east wild animals are not abundant in Urundi as a whole, although along the shore of Lake Tanganyika the smaller antelope, especially such forms as waterbuck, reedbuck, bushbuck, are numerous. The country in fact is too densely inhabited to permit of great numbers of wild animals. The Watusi do not eat wild game and pay little or no attention to it. They[19] regard the wild animals as men transformed for crimes committed during their human inhabitation of this world. Lions are supposed to be kings, while leopards are princes. Leopards and leopard cats are killed for their skins, which form a distinctive feature of the gala dress of the Watusi men. Elephants occur in the Rusizi valley. Rhinoceroses occur quite frequently along the southeastern border.

Inhabitants

Urundi is estimated to have a population of 1,500,000 people. Since the total area of Urundi is only 12,298 square miles, this means an average of 122 persons per square mile for the whole area. The Resident, P. Ryckmans, has stated that in certain sections of the country there are 100 persons per square kilometer, or 260 per square mile. The region is therefore densely inhabited, in which respect it contrasts markedly with other regions of Central Africa.[20]

The Warundi, or people of Urundi, comprise three races: the Watusi, the Wahutu, and the Watwa (Batwa). Authorities differ as to the relative proportions of these races. Burgt[21] gives for northern Urundi 20–30 per cent Watusi, but in his "Dictionnaire"[22] he gives 10 per cent as the relative number of Watusi. De Greef[23] and Franck[24] agree with Burgt. In a short report of an address by Ryckmans,[25] Resident of Urundi, the Wahutu are said to constitute 95 per cent of the total population, which would leave less than 5 per cent for the Watusi. Ten per cent seems a fair general estimate.

The Watusi constitute the dominant race and closely resemble the Bahima of Ankole (Uganda Protectorate) and other cattle-keeping aristocracies of east-central Africa and are generally believed to be of Hamitic origin from Galaland or to be the descendants of the early Egyptians. They have subdued the Bantu occupants of the countries into which they have spread.[26] The Watusi are a wonderful people. The men are tall—five feet

[19] Burgt, Dictionnaire, p. 33.

[20] See for comparative purposes the density of population map in Hans Meyer: Das Deutsche Kolonialreich, Vol. 1, 1909, p. 80.

[21] Burgt, Land und Leute, p. 324.

[22] Burgt, Dictionnaire, p. 4.

[23] De Greef, *op. cit.*, p. 36.

[24] Louis Franck: *Le Mouvement Géographique*, Oct. 23, 1921.

[25] *Bull. Soc. Royale de Géogr. d'Anvers*, Vol. 41, 1921, p. 194.

[26] Sir Harry Johnston believes that they may have originated in Egypt, an opinion not concurred in by C. G. Seligmann. See H. H. Johnston: A Survey of the Ethnography of Africa, *Journ. Anthropol. Inst.*, Vol. 43, 1913, pp. 375–421; especially pp. 419–421.

ten inches to seven feet two inches in height.[27] They are slender, athletic, with long faces, aquiline noses, and relatively thin lips. Their color is a chocolate brown to almost black. They are clean-faced and usually have shaved heads. Their eyes are clear and full of fire, and the expression is animated. Although they have had very little contact with the white race they show an intelligent and lively interest in the works of the white man and an appreciation of his knowledge. They are a race to be admired, and the traveler is glad to associate with them.

FIG. 10—Chief Ararawe (right), his son, and nephew. They wear a garment of calico, "Americana," over the bark cloth dress with raphia or banana fiber epaulets, a cloth band round the head, and on top a small wizard's vial, in Ararawe's case replaced by a green glass stopper. The white shell worn by the chiefs is seen on Ararawe's neck.

The manners of this people are exceptionally good. When they meet each other they give appropriate greeting. Among the chiefs this consists of a series of salutations while holding each other by the shoulder or elbow with both hands. According to Burgt a man says to his chief, "I sho, sho, sho, gir inka" (I hope your cattle are doing well). The reply is, "Eeh, eeh" (I hope yours are also). Since this people's regard for the cow amounts, as it did among the Egyptians, almost to worship, it is not surprising that salutations should take this form. The greeting is at times very long, lasting several minutes. It is subject to many variations, depending largely on the social position and relationship of the two men. It is carried on in a low tone, audible only within a few feet of the speaker.

The salutation between two men meeting for the first time in the day would run about as follows:

A. Mwakeye? (Good day?).
B. Mwakeye (Good day).
A. Amahoro? (All is well?).
B. Amahoro (All is well).
A. Uragumye? (And the women?).
B. Ndagumye (The women are well).
A. Neza (It is well).
B. Neza (It is well).

The greeting of the white man who understands none of the native language is generally carried out about as follows. The chief will first place on the ground the spear and bow and arrows which he always carries.

[27] Duke of Mecklenburg, *op. cit.*, p. 48.

He will then approach the white man and shake hands, while clasping the white man's hand in both of his.

The Watusi are wonderful athletes. Tall and lank, they excel in jumping and are also capable runners. In the high jump, with a small termite hill as a start, they clear a string at a little over eight feet.[28] They can easily jump over a tall man and over several cattle. As bowmen they shoot with terrific force but not very accurately. This lack of accuracy may be partly due to direction of attention to their prayer which is chanted dramatically while they hold the drawn bow. They also hold the long spear in the hand which draws the bow. In throwing the spear, which also is done with great force, they are much more accurate.

FIG. 11—Watusi dressed for the dance. Each wears an undergarment of dark bark cloth and a leopard or leopard-cat skin over the shoulder and around the loins. Around the ankles are dozens of small wire anklets. The white headdress is a piece of hide with the long hair standing out around the head.

In the dance the Watusi are entirely free from the bodily contortion so characteristic of negro dances. A large body of men elegantly dressed, each carrying a long bow and spear, move together as one man, the rhythm being perfectly maintained and made audible only by the rapid tapping of the feet and the swish of thousands of soft wire anklets. In front of the line of dancers one or more of the chiefs moves back and forth directing the dance. The whole is a great ballet unexcelled in grace and rhythm. At times the whole mass rises into the air in a high jump, but at no time is there any show of exertion. In one of the most impressive stages all kneel down on one knee and a poet recites the heroic deeds of the chief and his tribe.

THE SUBJECT WAHUTU

The Watusi own the cattle, control the land, and employ the Wahutus to do their work. The Wahutu are a Bantu race constituting, according to different authorities, from 65 to 95 per cent of the population. They are a subdued people and have been profoundly influenced in their manners

[28] *Ibid.*, p. 59.

and customs by the Watusi who entered the country several hundred years ago. They are tall, brawny, agile, active, and largely devoted to agriculture and trading. They would probably be pastoral if it were not for the Watusi, who have pre-empted this privilege. The more influential men of Wahutu often own one or two cows. Burgt (1912) regards them as far above the ordinary Bantu in intelligence. They accept with less reserve than the Watusi the teachings of the missionary and are regarded as more promising or pliable material on which to graft

FIG. 12—A Watusi dance. About 500 men are here taking part in a dance that reminds one of a great national ballet and is entirely unlike the usual negro dances. From one to six solo dancers are in front of the main line. In the photograph Chief Ararawe and his nephew are seen.

our customs, virtues, vices, and beliefs. If the country should be overrun by whites the Bantu would change gladly from the subservient position he holds with reference to the Watusi to a similar position with respect to the whites, while the Watusi with his racial pride and feeling of superiority would probably resent to the last an unjust domination.

There are no slaves in Urundi; and the position of the Wahutu is by no means a bad one, since they are recognized by the king and granted many privileges.

THE PYGMY WATWA

The Watwa are a race of pygmies dependent largely on hunting and are despised and called beasts by Watusi and Wahutu alike. They have probably occupied the country longer than any other tribe. They constitute less than five per cent of the total inhabitants and are especially numerous in the forests and along the river bottoms. They are nomadic, timid, cruel, fierce, and aggressive in war. The Watusi call them in derision "sons of the

FIG. 13

FIG. 14

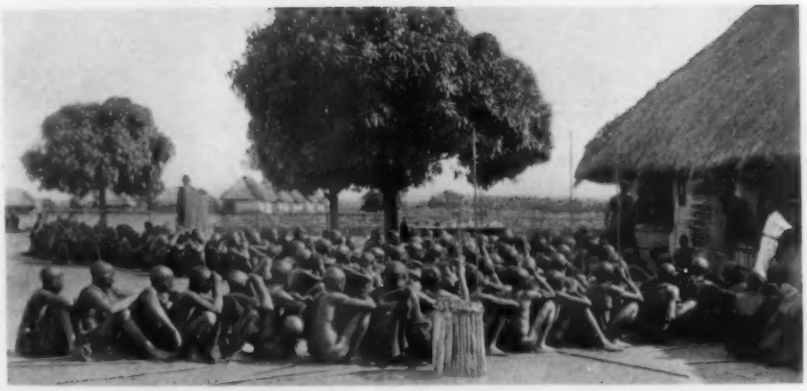

FIG. 15

FIG. 13—The chief interest of the Watusi is their cattle. These are large-bodied animals with unusually large horns (in general about 3 feet long). The cow shed at the right, which was constructed on plans submitted by the Belgian authority, is not typical of the huts used by the Warundi.

FIG. 14—Wahutu hoeing. They work more or less in unison and to song. At the beginning and end of the day's work they form a dancing party, using the hoe instead of the spear, and greet the Belgian officer for whom they are working.

FIG. 15—Chief Ararawe's men brought before the *chef de poste* to pay the yearly head tax of 2 francs.

elephant," "murderers," "tanners," etc., while the Watwa call themselves "sons of men."

Animal Industry

Cattle raising is the most outstanding feature of native industry. The Watusi are primarily cattlemen, and no land could be better adapted to that pursuit. It is a high, cool country, free from diseases ordinarily affecting cattle in the lowlands, and a great natural grassland furnishing forage throughout the year.

Fig. 16—Various types of baskets. The tall basket at the right is very light and has a design made by the use of a dark varnish-like material. Next to it are two well woven grass baskets of which the tops and bottoms are much alike and fit tightly together. At the left is a heavy double basket used to carry produce purchased in the market. The basket next without a cover is used in making cassava flour. At the right is shown a wooden container used especially in making palm oil. A woven sack is shown in the back at the left.

In this tribe, as among other cattle-keeping aristocracies of eastern Africa,[29] the regard for the animals amounts almost to worship and results in the greatest protection and care. The cattle (inka) are large, well-shaped, with enormous horns and large bodies indicating a foundation in the big-horned African race. The appearance of many of them is the same as those pictured in the Egyptian tombs and temples. They are valuable as beef cattle, although inferior to those of South Africa. The cattle are herded, as a rule, by the boys and are brought into the *boma* of the chief at night. Brands are apparently not used. The Watusi have a lengthy vocabulary[30] describing each type of cattle, corresponding somewhat to our terms—longhorn (inyambo), hornless or small-horns (ikongo), red (ikihogo), white (ikihororo), black (umugeyo), milch cow (inka u'amasa), heifer (icyacyi), etc. They assign to each animal a proper name, such as Nazoba, Kimonge, Mugamba, Ntaha, Rutangiriwangirye, Muvumuwavyayevyambu, etc.

The Watusi do not eat the meat of other domestic animals or of wild animals. This limits their meat diet to beef, of which they are very fond.

[29] Compare the Bahima and Banyoro of the Uganda Protectorate. See John Roscoe: The Northern Bantu, Cambridge, 1915.

[30] Burgt, Dictionnaire, p. 76.

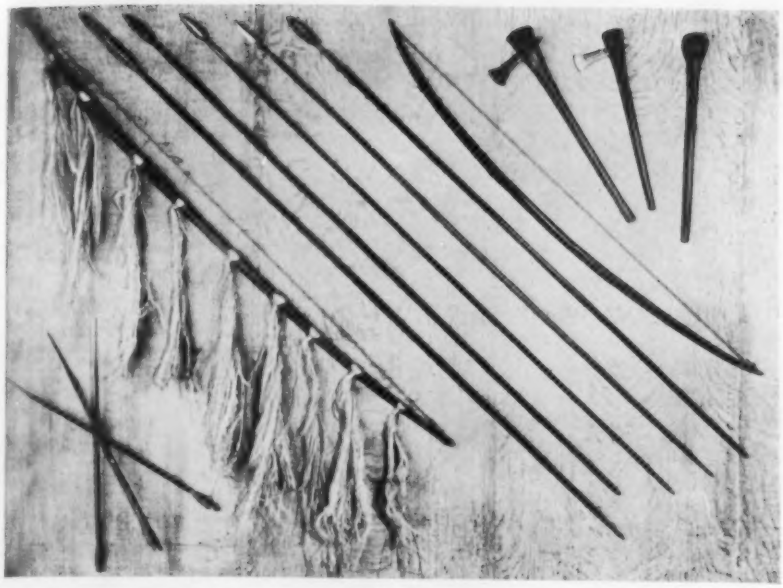

FIG. 17

FIG. 18

FIG. 17—The principal weapons of the Warundi. Beginning at the left are three arrows used by the Watusi; a Watusi bow (six feet long) decorated with banana fiber; five small-headed spears; a bow of the Wahutu made of dark wood and with a carefully made bowstring; two axes and a club. Almost every native carries an ax or a club and a spear or two.

FIG. 18—At the left the large wooden wristband used by Watusi bowmen to protect the hand and thumb from the sting of the bowstring; above several types of wizard foils, small wooden vials with stoppers, in which is carried a powder to protect the wearer from wizards; two knives, the shorter of which is worn on the upper arm and has a sheath held together by wire, while the longer knife carried over the shoulder by a braided cord has a sheath covered with raphia fiber.

According to the Belgian *chef de poste* at Nyanza they previously consumed the hides as well as the meat and blood, but this custom has been stopped by the Belgians in order that the hides may be exported. They bleed their cattle in much the same manner as the Masai but usually eat the blood cooked with beans.

These cattle produce relatively little milk, from a liter to a liter and a half a day. The average production of milk per cow for a herd ranging from 12 to 54 in number for 11 months at Nyanza[21] was 0.95 liter per day. The yield in butter amounted to only a tenth of a pound per day. The men do the milking, twice a day, at noon and in the evening. A wooden vase rounded on the bottom, about a foot long and four or five inches in diameter, is used to receive the milk. The vase is first cleaned with fresh cow urine. The calf is allowed to feed for a few moments, then the hind legs of the cow are tied, and the calf is led away. Usually several men engage in the milking, one or two to hold the calf, one to quiet the cow, and one to protect it from insects while still another does the milking. The milk is drunk both fresh and curdled. Most of it is used to make butter. This is done by rocking a calabash which contains the sour milk and cream back and forth until the butter is formed. Butter is never eaten by the natives but is used to smear over the body. It is, however, one of the chief export commodities.

There are estimated to be about 250,000 cattle in Urundi. They are therefore not numerous; but they are by far the most important economic asset, judged either by Watusi or European standards.

As compared with cattle all other domestic animals play a relatively unimportant part in the agriculture of the Warundi. Next to cattle goats are the most important. Both goats and sheep are kept, but only for trade. They are never eaten. The same is the case with chickens, which are rare in the interior of Urundi. Dogs are common. Cats and hogs are almost unknown.

Bees (inyuki) are kept by the Warundi. The hives are made from tree trunks or from papyrus or palm fiber. They are usually cylindrical, four to five feet long and about a foot and a half in diameter, and are usually hung from the limbs of trees. A swarm in the air[22] is brought to the ground by loud cries and by throwing water or dust among them. The honey is taken out at night with the use of smoke.

Plant Industry

The Wahutu are primarily agriculturists, probably not by choice, as has been said, but because they have been forced to give up the cattle to the dominant Watusi. The Watusi are, however, intensely interested in agriculture; the women, the men, and even the chiefs take part in the planting.

[21] De Greef, *op. cit.*, p. 64.
[22] Burgt, Dictionnaire.

FIG. 19

FIG. 20

FIG. 19—A field of elusine. This is one of the important grains of the highlands. It is used largely for food. The heads are relatively large, and the yield good.

FIG. 20—A field showing mixed planting. Corn and sorghum have been harvested. Colocasia is seen in the foreground. There are also young plants of cassava and beans. Since all cultivation is accomplished with the hoe the hillsides offer no disadvantages.

According to their belief[23] the king of Urundi when born holds in his hands the seeds of the different crop plants. At the proper time the king gives the signal, and all prepare the soil and plant the crops.

All land is owned by the king and is apportioned by him to the different chiefs and by them in turn to their people. These apportionments are not for a long period, and on them bribes are received. This leaves the whole matter of land tenure in an unsettled state.

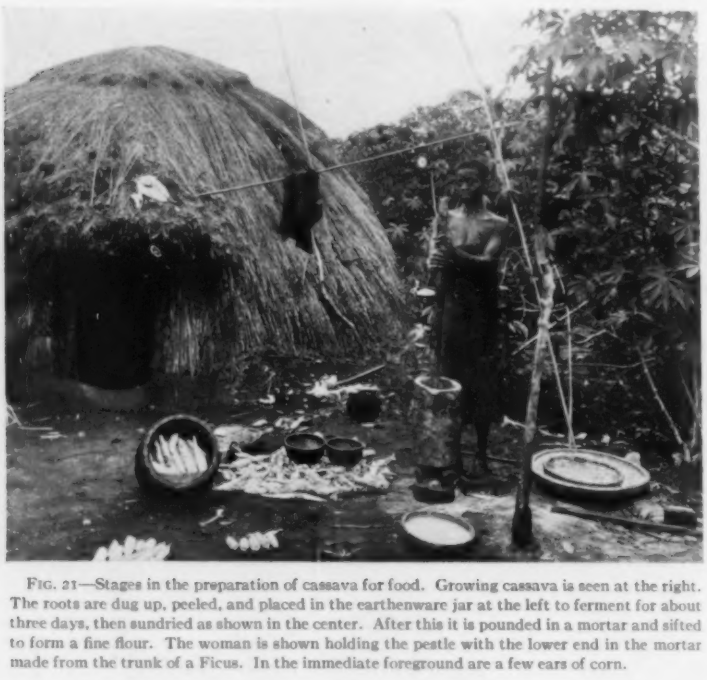

FIG. 21—Stages in the preparation of cassava for food. Growing cassava is seen at the right. The roots are dug up, peeled, and placed in the earthenware jar at the left to ferment for about three days, then sundried as shown in the center. After this it is pounded in a mortar and sifted to form a fine flour. The woman is shown holding the pestle with the lower end in the mortar made from the trunk of a Ficus. In the immediate foreground are a few ears of corn.

Annual crops are planted largely at the beginning of the rainy season. The land is first worked into good tilth with the hoe, the only instrument of tillage used by the Warundi. In many places the natives have employed irrigation, using a gravity method. The systems are sometimes quite complex and are often constructed under the chief's direction by all the men of the section. In that case all are supposed to profit equally by the system. Water is not only carried about the mountain on contour lines but is carried across canyons by means of dug-out tree trunks put in place by hand.

The agriculture of the uplands is devoted in the main to the cultivation of bananas, beans and peas, eleusine, sorghum, corn, colocasia, and sweet potatoes. Beans of many kinds are grown, and to a lesser extent the cowpea.

[23] Burgt, Dictionnaire p. 21.

Beans (ikiharage) constitute one of the principal crops, probably ranking with the banana as the most important agricultural crop, important as a food and also as an export crop. Burgt[34] gives Kirundi names for 101 different varieties. Almost all of these are *Phaseolus vulgaris* of different strains. They are usually boiled in water and eaten. Cowpeas are often cooked while still somewhat green and are eaten out of the pod.

Bananas (ikitoketoke) are grown extensively over much of Urundi. They form dense plantations on almost any type of land. As a rule they do best on the richer soil and where somewhat protected from the wind. Burgt[35] states that they almost disappear on the plateau of Mugamba at 6,750 feet elevation. They grow so naturally that the Watusi pay little attention to them, and the plantations are not well kept. The bananas are seldom eaten as fresh fruit but are usually picked green, peeled, and boiled. More often they are carefully packed into a pit surrounded by fresh banana leaves. They are covered with green leaves and above this with dry leaves and sticks, which are burned off. The pit is then covered, and the bananas are allowed to ripen. They are then peeled, macerated, and the juice expressed. In order to accomplish the rather difficult feat of separating the juice from the pulp of the banana they mix the pulp with grass and squeeze out the juice, throwing the pulp and grass away. This juice, added to water and allowed to sour, constitutes the sweet beer (umutobe) drunk chiefly by women and children. Since it is a nonintoxicating beverage it is deemed unworthy of the men. If the juice is mixed with the flour of red sorghum (made from dried germinated seed) it ferments and in four or five days is ready for use and is known as beer (urwagwa).

The banana plays a very important rôle as a fiber-producing plant. It also supplies the chief wrapping material. Beans, sorghum flour, and butter are all transported in banana containers.

Sorghum (isakka) is an important crop. There are two principal kinds, a white sorghum usually marketed as threshed seed, and the double-seeded, deep red type, usually marketed in the head. The method of culture is similar to that of corn, but when nearly ripe the heads with about two feet of stalk attached are cut off and stuck down into the ground to dry. The sowing of sorghum is accompanied by one of the chief festivals of the year, when all the people come together at the call of the king to celebrate the event. Even the Batwa are admitted to the presence of the king on that day. The natives do not attempt to produce in excess of their needs, and De Greef estimates the sorghum plantings to be three fourths of a hectare (under two acres) per able-bodied man.

Eleusine (uwuro) is also a crop of importance. It was seen growing extensively in the region about N'gano N'gano. The fields blended with the natural grasslands and could not be distinguished at a distance. They were usually small, from one to a few acres. This grain is made into a flour and

[34] *Ibid.*, p. 282.
[35] *Ibid.*, p. 64.

consumed as food and only rarely used to make beer. It is grown broadcast on soil kept level and not ridged.

Corn (ikiguri) does best in the moist valleys, where as many as three crops are grown a year. It is an important food crop. It is eaten raw by the children, is boiled on the cob or roasted, and is also ground into a flour and made into a thick mush. Corn is stored in the huts, tied up in trees in bunches with the husks on, and also stacked on bamboo fences with tips down. It is either husked in the field or the stems are cut below and above the ear to facilitate stacking on the bamboo fences. This latter method was employed on the lowlands along the lake. Corn is planted on a level soil surface, often among bananas. The seeds are usually soaked for one day before being put into the ground.

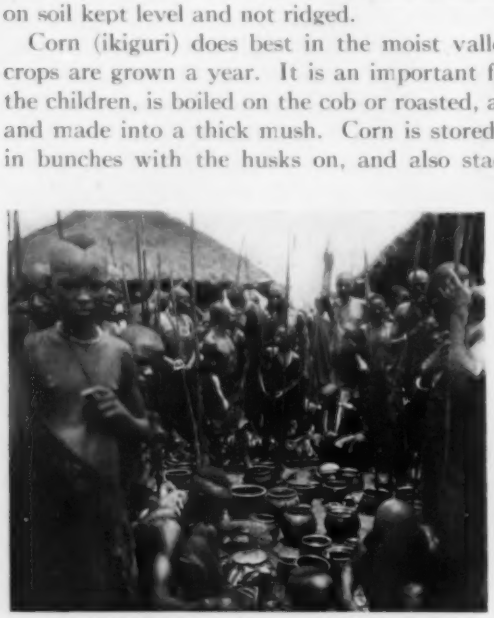

FIG. 22—Palm oil sold as an orange-colored liquid in earthern pots in the market at Nyanza. The pots are often covered with a green banana leaf tied on with banana fiber. The natives are Wahutu dressed either in "Americana," goat skins, or bark cloth. Each carries one or two long spears.

Sweet potato (ikizumbu) is planted either on a flat surface or sometimes in slightly raised beds. The roots are taken out of the ground whenever they are ready to be eaten. Colocasia (amateke) is also a relatively important root crop.

To the crops mentioned must be added pumpkin and squash, green peppers, castor bean, and various other vegetables. The leaves of beans are often eaten as spinach. Peanuts are also extensively grown.

In the region about the lake the oil palm (ikigazi) has been planted and constitutes one of the most important products. The natives here are Wahutu largely and are dependent almost entirely on agriculture. They gather the palm kernels and sell oil to the natives inland where oil cannot be produced. The export from the three chief centers of production, Nyanza, Rumonge, and Usumbura, amounts according to De Greef to about six tons per month, exclusive of the inland trade. Palm oil, like butter, is used by the natives to oil their bodies but is much more important as a cooking oil, used in the preparation of vegetables, beans, fish, and beef.

Cassava is the most important crop of the lowlands. A few plantations were seen on the uplands, but they did not look promising. The upland region is probably too cold. The stems are stuck into the ground two to three feet apart and soon grow to form a thicket four to ten feet high. At about the fourth year it is dug up, and another crop is planted. During

most of that time the plantation furnishes food, single plants being dug up or even a few roots removed.

It is eaten fresh, boiled, or baked. It is peeled, fermented for two or three days in a pot of water, dried in the sun, and boiled and eaten. After being peeled, fermented, and dried it is pounded into flour; and this flour is boiled to make a pasty loaf, one of the chief foods of the natives. In the market cassava is sold as fresh roots, fermented and dried roots, and as flour. It is also sold roasted, boiled, and as a loaf made of cassava flour. The leaves are sold as spinach. It is exported only as cassava flour.

Sugar cane is grown along the lake and here, as elsewhere in Africa, is eaten fresh.

FIG. 23—A Greek trader of the better type and his hut near the native market, Nyanza. In the photograph are shown cattle hides, palm kernels in baskets, beans, butter, and cassava flour in banana leaf containers. Wahutu traders at the left who have brought in their produce. The trader is seen in the back with his Swahili wife with the calico gown thrown over her head, and his three negro assistants.

MARKETS

Three markets in southern Urundi were visited by the writer—one at Nyanza, one on the Macombe River, and one at N'gano N'gano (see Fig. 2).

The markets of Urundi contrasted sharply with those seen in other parts of Africa. The men do the trading. At Nyanza a few women were present, selling beer (pombe) for most part; but in the mountains no women were seen.

At N'gano N'gano the market was held on an area of bare ground with no buildings of any kind. The same was true of the market at the river. At Nyanza two shelters have been constructed for the use of the natives. Under one of these beef, fish, and goat meat are offered for sale. The meat is usually cut up with the hide still in place and sold in relatively small pieces. The goat meat was sold to a small force of *Askari* maintained by the Belgian officials. There was no definite location for the different products. The following are among the more important:

Cassava—leaves to be used as spinach; fresh roots; roots baked or boiled; roots peeled, fermented, and dried; flour made of fermented dried roots; a dough cake made of cassava flour.

Beans—dry.

Cowpea—dry peas, also boiled, nearly ripe pods.

Corn—boiled, nearly ripe, still in husk.

Sorghum—white, shelled; red, still in head.

Palm oil—sold in earthen pots, three gallons for four hellers; nuts are occasionally sold with outer pulp still intact.

Sweet potatoes—roots, fresh, both white and red types.

Salt—one of the most important imports, sold in small lots wrapped in a leaf or banana fiber.

Eggplant—green or almost ripe.

Tobacco—as a dry leaf; as dry powder, or snuff; as a liquid for use in the nose.

Beer—either by the pot or by the drink.

Bark cloth; baskets; woven bags; mats; hats (wizard foils); knives.

FIG. 24—Butter is brought to the trader in banana leaf containers. For shipment to the warmer country it is melted and poured into gasoline or oil cans. Here two natives, a Swahili (in front) and probably a Congo negro, are seen carrying empty oil cans to be used for this purpose at Nyanza.

At Nyanza palm oil was sold in a fluid state in earthenware containers, but in N'gano N'gano it was sold as a solid, care being taken to protect it from the direct rays of the sun.

In the market at Nyanza the produce was presented to the trader in the following form:

Cassava flour, corn meal, and sorghum flour in banana-leaf containers, 15–25 kilos each; beans in long containers made of leaves; palm-oil nuts in baskets or grass and banana-leaf containers; palm oil in earthen pots emptied into gasoline or oil cans and shipped; salt imported in leaf containers.

At N'gano N'gano there was much less food in proportion to other articles than at Nyanza. Fiber, both banana and raphia, and charcoal were important articles of sale in this market. Charcoal is burned in the upland forest and brought to market in containers made of grass and bound about with bast fiber. Because of the scarcity of wood, however, much of the cooking is done with sorghum or cornstalks and similar refuse.

The market is largely a place where food products are exchanged. In the part of Urundi visited by the writer the currency in standard use was the German heller. The silver franc with an Albert head would pass for 44 heller; but paper or Leopold silver or even French Republic silver would not be accepted. Most of the exchange is done with the heller and the Albert franc.

Export

Most of the produce is consumed by the dense population, estimated at some 120 to the square mile. Cattle furnish the chief export in the form of hides. Some butter is also exported, and a little agricultural produce. De Greef[36] gives the minimum quantity of produce furnished each month by the natives at the lake ports in tons as in Table III. Exports are shipped by boat to Kigoma. From Kigoma butter and oil and hides are sent on to Dar es Salaam by rail, a distance of 780 miles. From here they are reshipped to India or Europe.

Table III—Monthly Exports from Lake Ports in Tons

Product	Nyanza	Rumonge	Usumbura	Total
Cassava flour	3.5	5	2	10.5
Beans and peas	3	3	20	26
Palm oil	1	5	0.2	6.2
Bananas	2	2		4
Peanuts			3	3
Corn meal			2	2
Cassava			2	2
Total				53.7

Routes to Urundi

Urundi and Ruanda are not easy of access. The shortest route to Urundi is through Tanganyika Territory by rail from Dar es Salaam to Kigoma (780 miles), which requires about two days, and thence by one of the small steamers that ply irregularly between Kigoma and the lake ports of Urundi. The total time required would be about ten days. To facilitate export and development of the rich resources of Urundi and Ruanda the Germans had projected a line from Tabora, on the Central Railway, to Kaseke at the junction of the Nyavarongo (Kagera) and Ruvuvu Rivers;[37] but no steps had been taken to put this in execution before the outbreak of the war. The considerable export trade of Ruanda in hides used to go out chiefly by the Uganda railway. From Mombasa to Kisumu on Lake Victoria is 584 miles by the railway; thence one goes by boat to Bukoba and by a trek of about 200 miles across to Urundi. The time required for this route is about 30 days.

Ruanda and Urundi lie more or less in the line of a Cape-to-Cairo route.[38]

[36] *Op. cit.*, p. 33.

[37] C. P. MacCarthy: German Plans for Railway Development in East Africa, *Geogr. Journ.*, Vol. 52, 1918, pp. 314–323.

[38] A Cape-to-Cairo time-table was worked out some time ago (*Commerce Repts.*, Mar. 7, 1918, p. 874). The *African World* (Dec. 17, 1921) announces a "Cook's Tour" from Cairo to the Cape under the guidance of Sir Alfred Sharpe, the itinerary of which is planned to go through "the very heart of the new Ruanda district of the Congo Colony" to Uvira at the northern end of Lake Tanganyika. According to Sir Alfred's schedule 36 days would be required to reach Butiaba and almost 80 to reach Lake Tanganyika. On the regular schedule for travelers on the route through Egypt, the Sudan, and Uganda, it requires connection between steamers which sail twice a month, and no very accurate schedule can be estimated.

The trip from Cairo to Lake Victoria can be made by rail, steamer, or motor with about 110 miles trek, then by boat to Bukoba and 200 miles across Urundi. This would require from 60 to 80 days. From Cape Town one can go by rail to Bukama and by steamer and rail to Albertville on Lake Tanganyika. This would require from 20 to 30 days. A partial alternative will be offered by completion of the Benguela-Kambove railroad. Another

FIG. 25—Sketch map showing the situation of Ruanda and Urundi in relation to contiguous territories. The former provincial boundary is shown by a dotted line, the boundary of the area held under Belgian mandate by a heavy dot-and-dash line. Scale of map 1:15,000,000.

approach from the west is by way of the Congo, a route requiring almost as much time as the trip up the Nile but one that can be made entirely by rail and steamer.

POLITICAL SITUATION

Because of the remoteness of Urundi and Ruanda, the character of the people and the form of government, German authority was only established slowly. "German supremacy is only recognized to a very limited extent," said Duke Adolphus of Mecklenberg in 1910.[29] At the outbreak of the war the German authorities had gained ascendancy over

[29] *Op. cit.*, p. 44.

the Sultan of Ruanda, whilst Urundi was still largely free of white domination. As a result of the war the two territories passed under the mandate of Belgium. The boundary of the mandated area, however, is not quite coincident with that of the former provinces; in particular, a strip of eastern Ruanda—a portion of the territory ruled by the native king of Ruanda—was retained by the British for construction of the Cape-to-Cairo line.[40] Politically Urundi is a feudal monarchy ruled by a monarch who possesses absolute power and is surrounded by a large court.[41] From him the chiefs receive their authorization and are apportioned their land and in turn exert absolute authority over their subjects. The first act of the Belgians was to restore and support the legitimate ruler.[42] He is a young boy about 10 or 12 years of age, and the government is in the hands of a council of three at the present time. Both the governor of the mandated territory and the Resident of Urundi are deeply interested in the welfare of the natives and are seeking to prevent their exploitation by Europeans. Care is being taken to preserve the native institutions, and it may be noted that the head tax (two francs) is much lower than in other parts of Africa. While European cereals and crops of industrial value are being introduced, the Belgian authorities are attempting primarily to foster production of the native resources and to build up trade with the natives on this basis. For instance the *chef de poste* at Nyanza was introducing better types of maize and also experimenting with cassava on the highlands and with cattle on the lake shore. To the writer it appeared that there was excellent good feeling between the Belgian officials and the natives and an attempt on both sides to co-operate for the mutual good.

[40] On this see the report by Capt. J. E. Phillips in the article "The Cape-to-Cairo Railway and Train Ferries," by H. Wilson Fox, *Geogr. Journ.*, Vol. 55, 1920, pp. 73–108.

[41] P. Ryckmans, Resident of Urundi, reported in *Bull. Soc. Royale de Géogr. d'Anvers*, Vol. 41, 1921, pp. 193–196.

[42] See the account of Ruanda and Urundi in *Le Mouvement Géographique*, Oct. 23, 1921, summarized from the official report of the minister of the colonies on Belgian administration in the occupied territory of former German East Africa.

ALONG THE ANDEAN FRONT IN SOUTHEASTERN BOLIVIA

By Kirtley F. Mather
Denison University

Amid cane fields and cattle pastures twenty miles east of the eastern front of the Andes lies the city of Santa Cruz de la Sierra, approximately at the geographical center of Bolivia. Its 25,000 inhabitants are cut off from contact with the outside world by almost insuperable barriers of mountains, sand-swept plain, and river swamps. On the north it is 80 miles to the head of navigation in the Amazon basin (Quatro Ojos on the Rio Pirai); on the east it is 400 miles to navigation on the Rio Paraguay (Puerto Suarez); southward it is 475 miles to the railhead at Embarcación, Argentina. In each of these directions only narrow trails or heavy oxcart roads mark the routes across the plains and through the jungle. Westward from Santa Cruz, communication with the more populous highlands of western Bolivia is precariously maintained by a 300-mile mule trail which climbs the successive ranges of the Andes to reach the railroad at Cochabamba.

From this isolated city the writer set forth in January, 1920, with two American companions and two Bolivian *arrieros* to explore the foothills of the Andes along the route which leads southward past the frontier city, Yacuiba, to Embarcación. In the comparatively short space of forty days we inspected in greater or less detail six of the mountain ranges and three of the groups of hills which occupy the transition zone between the interior plains on the east and the Andean Cordillera on the west in latitude 18° to 23° S.

The Santa Cruz Plains

The plains of Santa Cruz are the northwestern extension of the Gran Chaco, which occupies the entire southeastern quarter of Bolivia and continues southward into Argentina. Near Santa Cruz the altitude of this great interior plain is approximately 1,400 feet. Between the Rio Grande and Rio Pilcomayo its western margin rises to an elevation of about 2,500 feet, but still farther to the south near the Bolivian-Argentine frontier it again declines to 1,500 feet or less. The trails leading southward from Santa Cruz traverse for scores of miles the monotonously flat surface of this plain, which is occasionally crossed by shallow arroyos leading eastward from the mountain front. Near the mountains there are many low knolls and irregular rolling hills of sand, easily recognized as ancient dunes now anchored by vegetation. In places the trails pass by live dunes of glistening yellow-

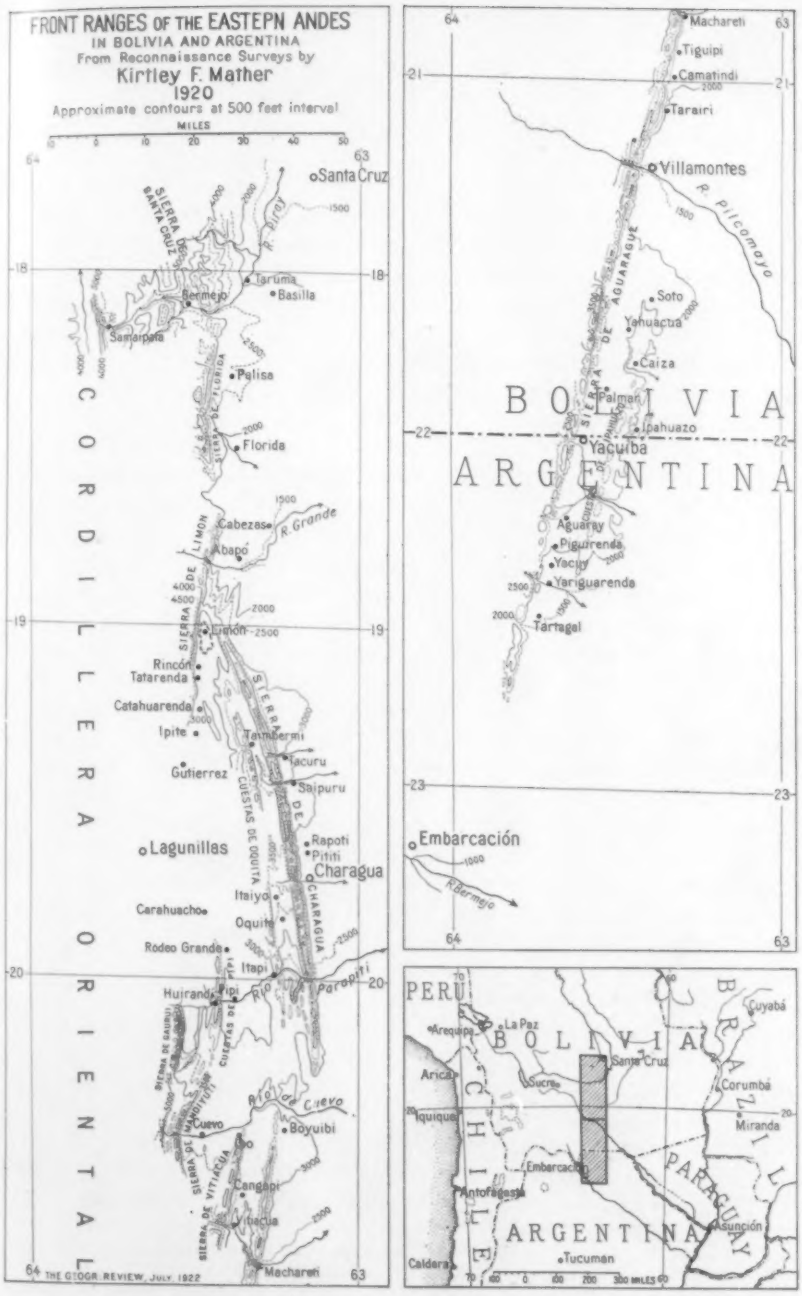

FIG. 1--Reconnaissance survey map of the front ranges of the eastern Andes between latitudes 17° 45′ S. and 22° 45′ S. Scale approximately 1:2,150,000. In the lower right corner, map showing location of the area surveyed.

white sand, restless beneath the shifting breezes of the plain. Among the sand hills during the rainy season there are numerous ponds and marshes which disappear at times of drought.

The Sierras

The eastern front of the Andean Cordillera rises abruptly from the western side of this plain and forms a broken wall, trending approximately north and south between the 63rd and 64th meridians. The mountain ranges along this margin of the Andes are for the most part long, narrow, sharp-crested ridges which rise to altitudes of 1,500 to 2,500 feet above their surroundings. Between the successive parallel ranges there are strips of undulating lowlands, two to fifteen miles in width, with only slightly greater relief than that of the Chaco beyond the easternmost range. The crests of the ridges display a marked accordance in summit level from end to end, and there is a regular increase in the summit elevation of successive ranges from east to west. Each is bordered on one or both sides by steeply inclined hogbacks rising abruptly from the adjacent plain. Some of the ranges display precipitous fault scarps along their eastern faces.[1]

Between latitude 18° 10′ and 18° 35′ S. the front range of the Andes is the Sierra de Florida, a "fault front" range, with a thousand-foot escarpment rising boldly and abruptly from the margin of the undulating lowland which terminates at the foot of the cliff. Its topography is exceedingly rugged and forbidding. To the westward it apparently merges into the successively higher ranges toward the heart of the Cordillera. This is the most northerly fault escarpment of any prominence along the front of the Andes in central Bolivia, for the Sierras de Santa Cruz display a very different topography. These sierras lie directly west of the city of Santa Cruz and are terminated on the east by hogbacks of resistant sandstone, which dip gently downward until they disappear beneath the Santa Cruz plains. South of Mt. Cuchilla, the most prominent peak in the southern part of the Sierra de Florida, that mountain group declines rapidly in elevation and in a short distance dwindles to a line of low hills.

A few miles farther to the south, in latitude 18° 40′, another mountain range, the Sierra de Limón, comes into existence. Within a short space its summits attain as great altitudes as those of the more northerly range with which it is approximately in line. It is also a "fault front" range with a bold escarpment overlooking the low plain which stretches eastward from its foot. West of Abapó the Sierra de Limón is broken by the valley of the Rio Grande, which flows towards the east directly athwart the range; but

[1] The orography and geology of the front ranges of the Andes south of Santa Cruz have recently been discussed by Guido Bonarelli: Tercera contribución al conocimiento geológico de los regiones petrolíferas subandinas del Norte (Provincias de Salta y Jujuy), *Anal. Minist. de Agric.: Sección Geol., Mineral. y Minería*, Vol. 15, No. 1, Direcc. Gen. de Minas, Geol. e Hidrol., Buenos Aires, 1921. See the maps of the region from latitude 19° to 26° S. and also the diagrammatic sketch of the front ranges, Plate I. The author had had no personal experience of the ground north of Charagua.

south of the river the mountains continue for more than 25 miles, nearly to latitude 19° 20′.

The Sierra de Limón is the front range of the Andes for only about half its length. The northern outposts of another range, the Sierra de Charagua, are found four or five miles east of the Limón range where it is crossed by the 19th parallel. The Charagua range continues for more than 80 miles to the south and dies out in latitude 20° 18′. It is a narrow, rugged ridge, only about four miles wide, bordered on either side by two or three series

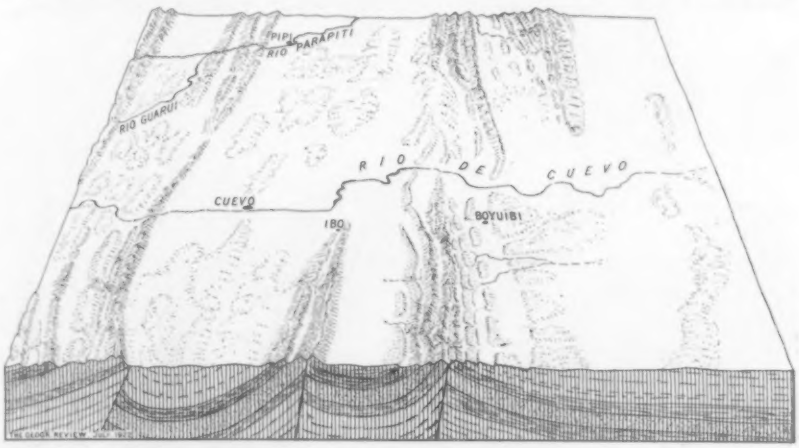

FIG. 2—Block diagram of the central section of the surveyed area (Fig. 1) compiled from data supplied by Kirtley F. Mather and other sources.

of steeply inclined hogbacks. Its higher summits attain altitudes of 4,500 to 5,000 feet above the sea, while the lowlands on either side are at elevations of 2,500 to 3,600 feet. The mountainous wall is breached at three points by narrow canyons through which the Rios Saipuru, Charagua, and Parapiti pass from the intermontane lowland west of the range to the plains which stretch eastward from its eastern foothills to form the Gran Chaco. No other front range of the entire Andes system is situated so far to the east as is this sierra. Both to the north and to the south the other front ranges are distributed *en échelon*, with each successive range a few miles farther toward the west than its predecessor in line.

A little over twenty miles west of the southern portion of the Sierra de Charagua there is another parallel but much shorter range known as the Sierra de Guarui. Among its peaks is the highest summit along the eastern margin of the Andes—an unnamed mountain whose serrate crest attains an altitude of slightly over 6,000 feet. The entire sierra is extremely rugged and youthful; its eastern margin is a bold fault scarp rising almost sheer for 1,000 or 1,200 feet above the floor of the broad lowland traversed by the Rio Guarui. This intermontane lowland, between the Sierras de Charagua

and de Guarui, is occupied by the Cuestas de Pipi and de Oquita, to which reference will be made in a succeeding paragraph.

South of latitude 20° 20′ S. the Sierra de Aguaraguë is the front range of the Andes. It begins as a line of low hills near Boyuibi, ten miles southwest of the southern end of the Sierra de Charagua, and, curving slightly westward, it extends for 170 miles, finally dying out in northern Argentina in latitude 22° 45′ S. Like the Sierra de Charagua it is a narrow, rugged, steep-sided range rising wall-like above the lowlands on either side. Unlike the more northerly range, however, its eastern face through a considerable

FIG. 3—The Santa Cruz plains stretch monotonously southward along the eastern margin of the Andean Cordillera. In the distance, beyond the plodding pack train, may be seen a group of live dunes of glistening yellow-white sand.

portion of its length is a fault scarp, although elsewhere it is bordered on the east by rank upon rank of steeply inclined hogbacks sloping away from the axis of the range. The mountain barrier is breached by two narrow canyons traversed by the Rios Vitiacua and Pilcomayo, whose sources are in the higher ranges far to the west.

West of the northern portion of the Sierra de Aguaraguë there are three parallel ranges of mountains into which my expedition penetrated. Named in order from east to west, these are the Sierra de Vitiacua, Sierra de Mandiyuti, and Sierra de Chireti. Each of these is a "fault front" range with an eastern face rising abruptly above an intermontane lowland of greater or less width.

GROUPS OF CUESTAS

Certain of the lowland depressions between the mountain ranges mentioned in the foregoing paragraphs are occupied by groups of hills or cuestas. These ordinarily consist of several westward-sloping hogbacks. In each group the elevation of successive ridges increases from west to east, and the

easternmost hogback is abruptly terminated by a prominent fault scarp. All these hogback ridges trend north and south in approximate parallelism with one another and with the higher mountain ranges. The individual hogbacks within each group of cuestas are separated from one another by narrow steep-walled valleys, the eastern wall of which is almost everywhere a dip slope controlled by resistant sandstone beds. Each group of hogbacks is bordered on either side by rather broad, flat-floored, intermontane depressions. The most important of the cuestas examined by us are the Cuestas de Oquita and the Cuestas de Pipi, situated between the southern

FIG. 4—The northern end of the Limón valley, with the Sierra de Limón in the distance.

quarter of the Sierra de Charagua and the Sierra de Guarui. A third group of hills is located east of the Sierra de Aguaraguë and is bisected by the 22nd parallel, which at that place is the frontier between Bolivia and Argentina. These hills, the Cuestas de Ipahuazo, are irregular rolling knolls and low hogbacks whose alignment is not nearly so perfect as that of the other cuestas.

THE LOWLANDS

The intermontane depressions between these various sierras and cuestas are strips of undulating lowland, two to eight miles or so in width, stretching north and south for long distances. They display a relief of 50 to 250 feet. The hills which modify the smoothness of these areas are invariably irregular in distribution and display soft rounded outlines, quite in contrast to the sharp profiles of the cuestas and sierras.

The northern part of the lowland which separates the Sierra de Limón from the Sierra de Charagua is occupied in part by Lake Limón. The lake is a placid sheet of water, unruffled even by strong breezes, mirroring the mountains which rise beyond it. Its surface area is only two or three square miles, and it has no outlet. It is fed by streams and springs which rise along

the foot of the fault scarp bordering it on the west. The water has a bitter saline taste, and the strand is crusted with salt, stained blue-green from algal growths along the shore. Nothing else lives in its waters, and no birds hover over its surface. It is the Dead Sea of this part of Bolivia.

The Rivers

The larger streams traverse this area with little apparent regard for the existing topographical features. The three largest rivers, the Rios Grande, Parapiti, and Pilcomayo, have their sources far to the west in the heart of the eastern range of the Andes system. Thence they flow in a general easterly direction, cutting through the successive ranges and cuestas in exceedingly rugged canyons, whose precipitous walls are a complete contrast to the gentler slopes of the broad, late mature valleys through which these rivers cross the intermontane lowlands. The Rio Grande is eventually tributary to the Amazon; the Rio Pilcomayo contributes its waters to the Paraguay; the Parapiti loses itself in broad marshes and swamps among the sand hills of the Chaco. If during seasons of excessive rainfall the Parapiti's volume is sufficient to permit its flow to continue across the plains, it is probable that a small percentage of its waters finally reaches the Amazon system.[2]

Other rivers, such as the Saipuru, Charagua, Cuevo, Vitiacua, and Guarui, rise within one of the inner sierras and flow thence across the intermontane depressions in broad open valleys until they reach the western side of the next range to the east. Through it they invariably make their way by means of extremely youthful gorges.

Climate and Vegetation

In spite of its tropical location the climate of this region among the Andean foothills is genial and well-favored. It is comparable to that of New Mexico or southern Colorado. Especially after my sojourn in the Amazon lowlands north of Santa Cruz, with their oppressive heat and debilitating humidity, it was an agreeable surprise to enter the foothill country with its invigorating atmosphere and pleasing prospects. The seasons are two: a wet season extending approximately from November to April and a dry season extending from May to October. During the dry season there are occasional showers, but on the whole there is a deficiency in rainfall, so that the smaller streams disappear and only the rivers from the higher mountains may be safely counted upon as a source of water supply. At this time the weather is occasionally quite cold.[3] Ice is reported to form during the night at Palissa and elsewhere, although the altitude is

[2] This was the opinion of J. B. Minchin, who described the waters of the rainy season as probably passing through Chiquitos to the San Miguel affluent of the Guaporé ("Eastern Bolivia and the Gran Chaco," *Proc. Royal Geogr. Soc.*, Vol. 3, 1881, pp. 401–420).

[3] In the dry season at Santa Cruz the temperature may go down to 7° C. when the south wind blows. See Theodor Herzog: Vom Urwald zu den Gletschern der Kordillere, Stuttgart, 1913, p. 36.

FIG. 5

FIG. 6

FIG. 7

FIG. 5—Rio Grande at the trail crossing near Abapó. The mountains in the distance are the Sierra de Limón. At the right are the Indians with their balsa logs making ready to pilot the mules across the stream. Beyond them, another group is loading the ferryboat with luggage.

FIG. 6—Lake Limón, the "Dead Sea" of this foothill region of the eastern Andes.

FIG. 7—The Guarui valley, seen from Dr. Gareca's hacienda. Beyond the white sand flats of Rio Guarui are the back slopes of the Cuestas de Pipi.

only 2,000 feet and the location is well within the tropical zone. In September it is not unusual for the Sierra de Charagua to be white with snow. During the wet season there are frequent heavy tropical downpours, but rarely does it rain steadily for more than a few hours. This is the time of greater warmth, but even when the sun is directly overhead the heat is not oppressive because of the almost constant breezes. Nearly everywhere, except in the lower valleys of the largest streams, the nights are cool enough to make a heavy blanket a desirable part of one's camp equipment.

The healthfulness of the region in general may be inferred from the number of very old men and women to be seen in every Indian village. Troublesome insects are of course abundant here as everywhere in the tropics, but very little malaria and no yellow fever were reported to me. On the whole, climatic conditions impressed me as being favorable to permanent occupancy of this region by the white man.

The sand hills and flats along the western margin of the Santa Cruz plains support a sparse vegetation of grassy turf and low scrubby bushes, among which the thorny wild pineapple is common. Occasional clumps of tropical trees testify to the presence of unusually moist lowlands. Where the hillsides are not too steep for the lodgment of soil they are generally mantled with a luxuriant growth of verdant tropical shrubs and trees. In places this vegetation of the "rain forest" type extends beyond the foothills upon the plain, and the main trail southward from Santa Cruz passes through two such *montes*, each of which is 15 to 30 miles in width, before it reaches the Rio Grande.[4]

Farther south, in the vicinity of Charagua, Cuevo, and Yacuiba, the lowlands are generally covered with rather sparse jungle vegetation with many open grasslands eminently adapted for grazing. Figs, oranges, palms, etc., grow wild upon the hillsides; and corn, cacao, rice, wheat, yucca, and cotton are cultivated on the bottom lands.

The Indian Tribes

The Indian inhabitants of this foothill region are known as the Chiriguanos,[5] but they apparently have no tribal organization nor unity of customs. They were first encountered by white men in December, 1609, when Franciscan missionaries explored the mountains and pushed onward to the margin of the Chaco.[6] In the seventeenth century it was reported that it

[4] On the *monte* formation, see Theodor Herzog: Formaciones vegetales del Este de Bolivia, *Bol. Soc. Geogr. de La Paz*, Vol. 10, 1912, pp. 159–190; on the *monte grande* see *idem:* Vom Urwald zu den Gletschern der Kordillere, p. 133.

[5] On the Chiriguanos see the works of the Franciscan missioner, Bernardino de Nino, who has lived many years among these Indians: Etnografía Chiriguana, La Paz, 1912; and *idem:* Guia al Chaco Boliviano, La Paz, 1913. The Chiriguanos (with the Chané) have also been specially studied by Erland Nordenskiöld: Indianerleben, Leipzig, 1912; and *idem:* The Changes in the Material Culture of Two Indian Tribes Under the Influence of New Surroundings (Comparative Ethnographical Studies, Vol. 2), Göteborg, 1920.

[6] Nordenskiöld is of the opinion that the Chiriguanos only migrated into the Andean foothill region in the early sixteenth century and that associated with them were several Portuguese ("The Guarani Invasion of the Inca Empire in the Sixteenth Century: An Historical Indian Migration," *Geogr. Rev.*, Vol. 4, 1917, pp. 103–121).

was impossible to penetrate this region because of the extraordinary numbers and unusual ferocity of its aboriginal inhabitants, and it was not until the latter half of the nineteenth century that any determined effort was made to civilize this people and to advance Bolivian settlement towards the Chaco. Between 1850 and 1890 a score of Franciscan missions were established in various localities among the foothills, and as a result of the friendly advances of the *padres* the Indians are today on terms of entirely peaceful friendship with the white men. Farther out upon the Chaco toward the east there are many scattered bands of Sirionós and Sirácuas, who are still in the stage of hostile barbarism; but not since 1892 has there been any real conflict between the Chiriguanos and the white settlers.

FIG. 8—The canyon of Rio Vitiacua in the Sierra de Aguaraguë.

These Indians of the lowlands are much cleaner in their personal habits than the Aymara and Quechua Indians of the better-known plateau provinces of Bolivia. Their few clothes are a striking contrast to the bulky apparel of the mountaineers, and they seem to spend a considerable portion of their time bathing in the rivers and washing their garments on the gravel bars. Soap is an exceedingly rare luxury, and the technique of the laundry is based upon the abrasive power of cobblestones between which the soiled clothes are pounded until either the dirt or the cloth disappears. Consequently ragged or much-patched garments are quite fashionable. The close contact with white people has provided an abundance of calico and gingham of foreign manufacture, but many of the Indians still prefer the homespun fabrics woven from the native cotton of the region.

For the most part we found them hospitable and friendly, quite ready to guide us through the maze of cattle trails, delighted to have us camp beneath a fig or algaroba tree in close proximity to their water holes, and

sometimes willing to sell us maize for our mules or eggs for our "table." They display the customary indolence and improvidence of savages domiciled in a land where creature comforts can be obtained with slight expenditure of energy.

According to Father Bernardino de Nino at the present time there are between 22,000 and 26,000 Indian inhabitants of this region, and practically all of them have embraced the Catholic religion as proclaimed to them by the Franciscan monks. A few of them are living as peons on the cattle ranches or estates of the Bolivian dons who have acquired a small proportion of the more fertile lands, but the great majority are distributed in villages varying in size from a half-dozen to 300 bamboo-thatched huts, which are always located close to the banks of one of the numerous streams flowing eastward from the mountains. Some of these villages are cattle stations on the larger estates, and in them there is always a Bolivian overseer—one of the lesser cogs in the feudal system which dominates this frontier of civilization. Other villages are in close proximity to Franciscan missions.

Many of the Chiriguanos whom we met south of Cuevo and Boyuibi were decorated with daubs of brilliant red paint, splashed liberally upon their faces and bodies. Some of them had also large green buttons fastened into holes in their lower lips. Most of them wore necklaces of beads, teeth, etc., in which the tin Bolivian ten-centavo coin generally occupied the place of honor. Nowhere did we see the brilliant-hued baubles made of toucan and macaw feathers that are prized so highly by the Indians of the jungles of northern Bolivia. Especially north of the Parapiti I was impressed by the musical predilections of the natives. Nearly always the men carry reed flutes with them wherever they go, and they are constantly playing weird melodies as they ramble along the trail.

The Franciscan Missions

The missions of Santa Rosa and Tareiri are the two most imposing of the many seen between Santa Cruz and Yacuiba. Santa Rosa crowns a low hill in the lowland, three miles south of Cuevo. Over its main doorway are the words, "Euntes docete omnes gentes, S. Matth. xxviii, Mision de S. Rosa, 1887." The Mission at Tareiri is much older, having been founded in 1854, and its walls have more than once served as bulwarks behind which the doughty padres repulsed the onslaught of hostile savages. Each of the missions is surrounded by a considerable village, and from each the padres make occasional pilgrimages to the outlying settlements to heal the sick and collect the gifts and offerings of their parishioners.

It is the purpose of the Franciscans to gather into their schools all of the Indian children and, although the padres are fluent in the native dialects, instruction in the schools is in Spanish. Thus the Indians are gradually being weaned away from their ancestral tongues. To the traveler in these lands this phase of mission work is obviously advantageous, for among the

youngsters in nearly every community there will generally be at least one who is delighted to act as interpreter for him.

Each of the missions has its own agricultural establishment with vineyards, maize fields, rice paddies, etc., where the villagers labor under the direction of the padres. All of the inhabitants of the villages established by the missionaries are in a state of practical serfdom, and in each locality the missionary is the benevolent monarch of all he surveys.

FIG. 9—The Franciscan mission of Santa Rosa, three miles south of Cuevo. In the distance at the right is the Sierra de Mandiyuti. The topography is typical of the intermontane lowlands.

In strange juxtaposition in one of the chambers behind the altar of the Santa Rosa church there is a well-stocked dispensary and a miscellaneous collection of plaster saints awaiting each its own *fiesta* day, when it will be gayly decorated and carried in the van of a solemn procession winding down from the chapel and through the village streets. In spite of the great amount of good which the padres are doing with their schools and medicines, it is disappointingly true that they are also fostering the spirit of ignorant superstition and blind idolatry so easily aroused in primitive minds. The pomp and ceremony of the *fiesta* processions and religious services doubtless make a strong appeal to the Indians, and with the aid of an occasional "miracle" the friars easily maintain their position of limitless autocratic power in the community.

THE TOWNS

Of the score of Bolivian settlements large and small through which we passed on the journey from Santa Cruz to Yacuiba, the towns of Charagua and Cuevo are easily the most progressive.

Charagua is a village of something over a hundred tile-roofed adobe houses close-huddled in a compact group with the inevitable plaza at the center. Several good stores, where bread, chocolate, sugar, rice, and cloth can be purchased, face upon the plaza. At the time of my visit, February, 1920, the report was current that one of the large English trading concerns of northern Argentina was soon to open a post at that place, but no foreigners had as yet established themselves in the community. In the center of the plaza is a well, dug to a depth of 60 feet, which renders it unnecessary for the Charaguans to make the daily trip to the river for their supply of water, as do other villagers.

Cuevo is a similar village a few miles east of the Sierra de Mandiyuti. The surrounding region is excellent cattle country, and in the town the most progressive family is one which had migrated thence from France just after the war and is running a small tannery as an adjunct to their little store. Villamontes, on the north bank of the Pilcomayo River, is veritably a German settlement. One of the more powerful South American mercantile houses owns several hundred square miles of cattle lands along the Pilcomayo River, and their ranch headquarters and main trading post are located here. Their transportation route for export of hides and import of trading stock is to the southward past Yacuiba to the Argentine railroad at Embarcación.

Yacuiba is a much larger village, the capital of the province of the Gran Chaco. It was originally established on what was supposed to be the frontier between Argentina and Bolivia, but when that frontier was surveyed by the international commission it was found that the boundary line was a mile and a half north of the town. In spite of this fact the Argentine Republic has left the Bolivian government in complete charge of the village and its surroundings. There is even an Argentine consulate in the town. Traveling southward one does not encounter the Argentine customs officials until several miles south of Yacuiba, well within Argentine territory. Even beyond that point, at least as far south as Tartagal, the upper classes among the scanty population are dominantly Bolivian rather than Argentine. In Yacuiba there are branch houses of two or three German and English trading companies which at present have a secure hold on the trade of northern Argentina, and there is also a sprinkling of Spanish, Italian, and French immigrants.

The Bolivian government maintains a monthly mail service between these various towns as far north as Saipuru. From Boyuibi southward in front of the Sierra de Aguaraguë there is a telegraph line which connects the various scattered towns. Unfortunately the wire is out of commission much of the time, but when it is working, it is possible to send messages from these isolated hamlets to any place in the world. Four miles north of Yacuiba there is a powerful wireless station maintained by the Bolivian government in order to keep the soldiers along the frontier in touch with the authorities at La Paz.

Trails and Roads

Throughout the entire area traversed by us in our explorations among the foothills there are no improved roads. Cattle paths lead everywhere, and all the Indian and Bolivian settlements are connected by a network of fairly good trails. In very few localities is it necessary to spend much energy cutting paths through the jungle, as there is ordinarily plenty of open country through which the trails may easily go. Near the larger towns the trails have been used by oxcarts, which traverse the open plain

Fig. 10—The Franciscan mission at Tareiri, a few miles east of the Sierra de Aguaragüe. This is one of the first of the many missions of this region of Bolivia and was established in 1854.

with nearly as great freedom as the saddle animals. The numerous unbridged arroyos and small stream courses are, however, such barriers to wheeled vehicles that carts seldom go more than a score of miles from the place where they were made.

The two-wheeled carts are rough-hewn from the native woods, cedar and mahogany being commonly used. The huge wheels, four to six feet in diameter, are fixed on wooden axles. Grease is practically an unknown quantity so far as these carts are concerned, and hence their slow progress is accompanied by a constant chorus of squeaks and groans.

In 1913 the arroyos crossed by the trail leading northward from Embarcación past Yacuiba to Charagua and Cuevo were bridged to make possible the transportation of oil-well machinery to drilling sites near the two last-named towns. Since then most of these bridges have dropped to pieces, and this road is now practicable for wheeled vehicles only as far north as the Pilcomayo River. From Soto southward the road is still in fairly good condition, and in and near the little towns along the way I noticed a few four-wheeled wagons with metal tires and hubs of foreign

manufacture. Improved methods of transportation are gradually advancing northward from the Argentine into this part of Bolivia.

For the traveler on horseback or with mule train the only difficult parts of the journey from Santa Cruz to Embarcación are the river crossings. Many of the streams cannot be forded in time of flood, but except for the danger of quicksand even the Parapiti is passable at any time during the dry season and at frequent intervals during the wet. The Rio Grande and the Rio Pilcomayo, however, are seldom low enough to be forded with safety. At the more important trail crossings there are little settlements of Indians who make it their business to assist in the passage of the river. Luggage, saddles, and all equipage are ferried across in crude flat-bottomed boats which are carried a half mile or so downstream before the frantic efforts of the Indian oarsmen bring them to the farther bank. Mules, horses, and cattle are forced to swim the river under the guidance of the band of Indians, each of whom is provided with a log float of balsa wood without which none ever ventures far from shore in such turbulent rivers as these.

Agricultural Development

This is preëminently a cattle country. The sparse vegetation of the lowlands resulting from the somewhat meager rainfall is nevertheless sufficient for the sustenance of vast herds of cattle. What little utilization has been made of the agricultural resources of the region is chiefly based upon the nutritious grasslands. There are numerous cattle ranches in the vicinity of each of the larger Bolivian settlements, such as Saipuru, Charagua, Cuevo, Camatindi, Villamontes, Caiza, Palmar, and Yacuiba. At nearly all of these there is a considerable acreage of corn and sugar cane under cultivation. Each ranch house boasts a large wooden cane press, and many *estancieros* have crude stills where alcohol is made from the cane syrup. Apparently the only important exports are hides and alcohol, which may be transported on mule back, and cattle, which are driven southward to the markets of northern Argentina. In the vicinity of Yacuiba the cows are milked once a day for a period of two or three months, and cheese is manufactured as the only nonperishable milk product suitable for export from an iceless region, into which the condensery and its tin cans have not yet come.

There are a few large estates, each covering 40 to 200 square miles, scattered among the hills at some distance from the towns. One of these estates, occupying 70 square leagues along the Parapiti River west of the Charagua range, is owned by a Bolivian, who lives at Pipi in a bamboo-and-mud house scarcely distinguishable from the Indian shacks. Another far more pretentious estate is the *hacienda* of Dr. Gareca in the Guarui valley between the Sierra de Guarui and the Cuestas de Pipi. His *finca* is a large frame building in which many of the windows are glazed; there is every evidence of a desire to make the place clean and comfortable for the owner

FIG. 11

FIG. 12

FIG. 11—The Indian (Chiriguano) village at the mission of Tareiri.
FIG. 12—An Indian village, Itapi, typical of the settlements at a distance from the missions of this foothills region.

and his family. Most of these large estates are managed by *administradors*, who seldom display much capacity for thrift or industry; the owners live in Buenos Aires or Paris. It is quite evident that the absentee landowner system is utterly failing to make the most of the opportunities offered by this land.

Future Possibilities

Entirely apart from the probable mineral wealth, such, for example, as that represented by petroleum, of which indications have been obtained at many points in this portion of the Andean front,[7] it is plainly evident that this is a land of rich promise. The development of its agricultural resources has hardly begun. The excellent kitchen gardens and vineyards maintained by the Franciscan padres at many of the missions are proof of the possibility of successful cultivation of a great variety of farm and garden products. The relations between the streams heading in the rain-drenched mountains farther west, the dam and reservoir sites in the canyons through the various sierras, and the wide-spreading lowlands between and beyond the parallel ranges are ideal for the construction of irrigation systems to supply moisture for the thirsty soil where such is needed.

In spite of the tropical location the climatic conditions seem entirely favorable to the settlement of the region by white men. Its backwardness appears to be mainly a result of its remoteness from the established centers of civilization. This remoteness, however, cannot delay much longer the settlement of this land by energetic and ambitious pioneers. A preliminary survey for a railroad to run from Embarcación to Santa Cruz by way of Yacuiba, Villamontes, and Charagua has already been completed. The Bolivian government, however, is opposed to the construction of such a railroad until after the completion of the Cochabamba-Santa Cruz Railroad, also *en proyecto*, because of the fear of increasing the already close co-ordination of eastern Bolivia with Argentina before the contacts of eastern Bolivia with western Bolivia are perfected. Both these railroad projects, however, will probably be consummated within ten or fifteen years.

In northern Argentina, between Embarcación and Tucumán, the land is already fairly well populated and is occupied by hundreds of profitable estates from which wheat, sugar, and corn are today being exported in large amounts. The contrast between the modern homes and thrifty appearance of the northern Argentine towns and *haciendas*, on the one hand, and the squalid huts and vast vacant spaces of eastern Bolivia, on the other, is an object lesson which cannot but direct attention toward the possibilities of the more northern area. The frontier of civilization is creeping northward along the mountain front; in the next few years one may confidently expect great changes in this pioneer land.

[7] See Bonarelli, *op. cit.*, and bibliography contained therein.

THE DISTRIBUTION OF FUTURE WHITE SETTLEMENT*

A WORLD SURVEY BASED ON PHYSIOGRAPHIC DATA

By GRIFFITH TAYLOR
University of Sydney

With the passing of many purely artificial military and political boundaries we may look with more certainty to a time when the unrestrained economic resources of a region shall be the controlling factors in determining its prosperity and the density of its population.

For the past ten years the writer has been engaged on economic physiographic research in regard to the continent where such problems are presented in their simplest form. In Australia we are free from the presence of an alien racial element, and our climatic controls are relatively simple and are not confused by great topographic variation. At the same time a large range of climates, from the hottest tropical in the northwest to the cool temperate of Tasmania, affords a broad basis for comparative research.

In papers recently published[1] I have determined for Australia the temperature and humidity controls governing white settlement and the temperature and rainfall controls determining the economic limits of the main industries. On these bases I constructed a map showing how the future settlement of tropical Australia might reasonably be expected to be distributed.

The present paper is an attempt to carry out a similar investigation for the world as a whole and so to deduce the economic status of the continents including Australia. I have confined my study to the so-called white race, i.e. Europeans and their descendants, because data as to its climatic controls are available. This is not the case, so far as I am aware, with regard to the Mongolian or Negro races.[2] The white race has no opportunity or wish to supplant the yellow or black races in a broad belt of the Old World extending from Liberia to Japan, a limitation indicated by the boundaries in the map of future populations (Fig. 8). I have, however, thought it of

* I have to thank Professor Skeats for reading the manuscript and making many helpful criticisms.

[1] Griffith Taylor: The Control of Settlement by Humidity and Temperature, *Commonwealth Bur. of Meteorol. Bull., No. 14*, Melbourne, 1916.

Idem: Geographical Factors Controlling the Settlement of Tropical Australia, *Queensland Geogr. Journ.*, Vols. 32–33, 1918, pp. 1–67; abridged in *Geogr. Rev.*, Vol. 8, 1919, pp. 84–115. See especially the map (Fig. 23 in the abridged version) of potentialities of settlement in tropical Australia.

[2] I use the terms "white" race and "Mongolian" race in their generally accepted usage. There is, however, no doubt in my mind that the *Alpine* Europeans are closely akin to many so-called Mongolian, Indonesian, Polynesian, and Amerind peoples; while the other "white" races have millions of close ethnical relations in America, Malaya, etc. I have developed this thesis of migration zones in "Climatic Cycles and Evolution," *Geogr. Rev.*, Vol. 8, 1919, pp. 289–328, and "The Evolution and Distribution of Race, Culture, and Language," *ibid.*, Vol. 11, 1921, pp. 54–119.

interest to carry my investigation into these debarred regions, though here the results are outside the realm of practical geography.

The problem falls into three divisions. First, it is necessary to decide on the major controls which determine white settlement. Secondly, we must assign relative values to these several controls. Thirdly, we must classify the many diverse regions of the world, so that each unit shall be capable of quantitative consideration in terms of the controls determined upon.

My method has been as follows. I have subdivided the continents into economic regions. Each of these regions is tabulated in terms of what seem, in the writer's opinion, to be the four dominant controls (temperature, rainfall, location, and coal reserves). From these a quadrangular graph—the *econograph*—is constructed for each region. The area of this graph is found to represent approximately the habitability of the region concerned. Lines of equal habitability (isoikētes) are drawn on a map of the world. Using the present European populations as a criterion of reasonable saturation, it is shown that these isoiketes may be translated into isopleths of future population.

The map indicates that white settlement will tend to congregate around five world centers, or clusters of cities of a type which Geddes has named "conurbations." These are near London, Chicago, Sydney, Durban, and Buenos Aires. Of these the center in the United States will probably be the largest.

Economic Regions

In an investigation which contains so many variable factors the personal equation of the writer is bound to enter to some extent. The only way to counteract this is carefully to classify the regions involved and then to allot them economic values according to a fixed scale.

The economic regions which I have used, numbering 74 in all, are shown in Figure 1. These are much the same as Herbertson's natural regions[3] in the temperate zones. I have inserted the boundary between Europe and Asia; and, as the European plain varies so greatly in its economic resources, I have divided it into three units, approximately according to temperature. In Asia the Siberian belt is also separated into a western lowland and an eastern highland portion. The northern and southern halves of China differ greatly in resources and are subdivided. My studies of tropical Australia have led me to distinguish other types in the torrid zone, and it is here that I have modified Herbertson's regions most largely. Diverse topographies and differences in the rainfall types determined the subdivisions. The Saharan and Australian arid regions are divided in accord with the line separating the summer from the winter rain regions. This is, however, not of great economic importance. In North America the modifications are not marked. I have extended the Tundra region to the south; and on the

[3] A. J. Herbertson: The Major Natural Regions: An Essay in Systematic Geography, *Geogr. Journ.*, Vol. 25, 1905, pp. 300–312. The classification is carried further in "Oxford Wall Maps, Natural Regions," 1912.

east I have recognized three other regions, Eastern Canada and the Northeastern and Southeastern States.

The areas of these regions are given in the first column of Table IV. They were determined by planimeter and are approximate only. I have named the region in accord with the chief country or province included, but the economic and political boundaries rarely coincide.

Temperature Control

A glance at an ethnographic map of the world will show that temperature is the primary control in determining the distribution of the white race; but the optimum temperature and the upper and lower limits require considerable investigation. My own investigations have shown that a wet bulb temperature of 50° and a relative humidity of 75 per cent are near the optimum for the white race.[4] Unfortunately few countries publish wet bulb data, but the usual dry bulb reading under these conditions is close to 53° F. Huntington,[5] by an entirely different method, arrived at 60° F. as the best temperature for strenuous physical work and 40° for mental work. The upper temperature limit for fairly close white settlement seems to be about 70° F. (average annual temperature) or a little over. The chief "white" regions where such conditions obtain are in Brazil and northern Queensland. The chief control of the lower limit is economic rather than hygienic. The polar boundary of agriculture is not far from the annual isotherm of 30° F. We may therefore adopt these temperatures, 30°, 53°, and 70°, as critical values in our investigation.

Any world-wide study of temperature is greatly handicapped by the fact that published maps almost without exception show isotherms *reduced to sea level*.[6] This may be essential for forecasting, etc., but it makes the map almost useless for the economic geographer. Obviously it is not of much use to know that Tibet would have a temperature of 70° if it were at sea level, when actually the thermometer is usually below freezing!

In Figure 2 I give an approximation to the *actual* average annual temperature chart of the world. It is based on Buchan's map in Bartholomew's Meteorological Atlas, but is modified in accord with data in Hann's Handbuch der Klimatologie and elsewhere. The factor of 10° F. decrease with each 3,000 feet elevation has been used in calculating the temperatures. Little alteration is necessary in Europe and Australia, but Africa and especially Asia show striking convolutions in the isotherms.

The usual maps tend to give a wrong impression of inland Asia. We see that vast areas are too cold to have any value as areas of close settlement. On the other hand, there is a corresponding improvement in Africa, espe-

[4] Griffith Taylor: The Control of Settlement by Humidity and Temperature (discussed in the *Geogr. Rev.*, Vol. 4, 1917, pp. 401–403, and Vol. 5, 1918, p. 86).

[5] Ellsworth Huntington: Civilization and Climate, New Haven, 1915.

[6] A. J. Herbertson: Thermal Regions of the World, Oxford Wall Maps, 1909, shows mean actual temperatures (isotherms 32°, 50°, 68° F.) for January and July.

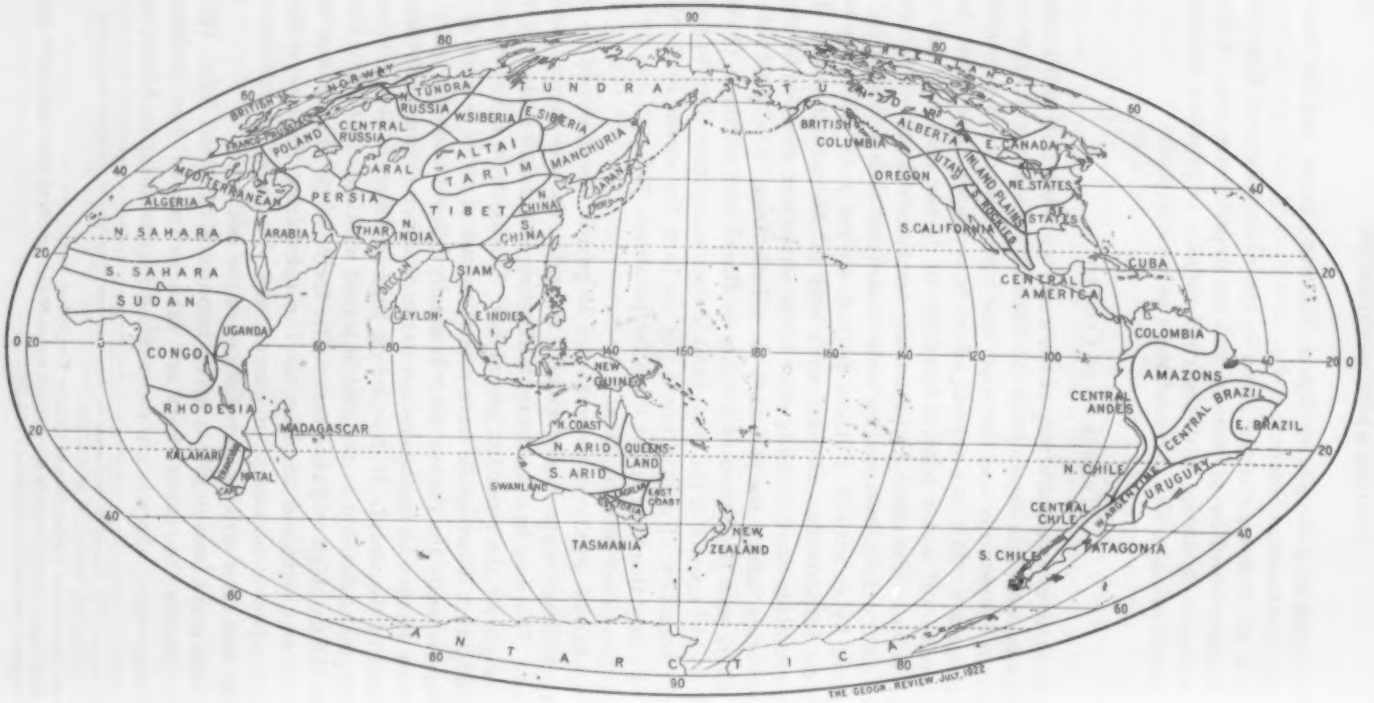

FIG. 1—Major economic regions of the world (boundaries partly after Herbertson). For the area and economic factors of the regions see Table IV.

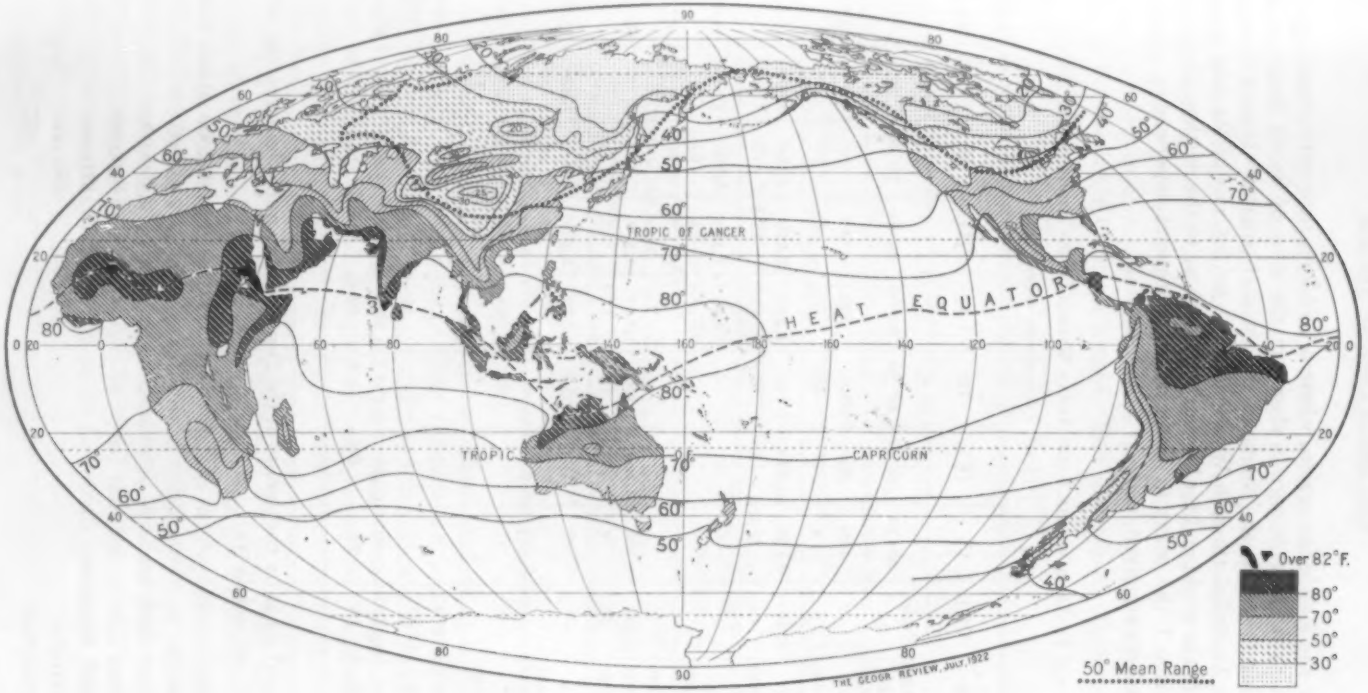

FIG. 2—Actual average annual temperature (i.e. not reduced to sea level). The region of great annual range of temperature (over 50°) is enclosed within the dotted line. The heavy broken line shows the heat equator passing through the four hottest regions of the world: 1, Timbuktu; 2, Massowah; 3, Tinnevelli; 4, Wyndham.

cially in the Rhodesian region, where a cool loop runs north nearly to the equator. The same feature is shown in the west of South America. An interesting feature is the course of the thermal equator. It runs far south in West Australia, through Wyndham (15° 30′ S.), one of the four hottest regions in the world and far hotter than anything to the north or south of it.

In Table I the areas in the various continents experiencing specified temperatures are given.

TABLE I—APPROXIMATE LAND AREAS WITHIN GIVEN TEMPERATURE BELTS

(*Unit, 1,000 square miles*)

VALUES	VIII	VI	IV	II	I	III	V	VII	Total
Temperature in degrees F.	Under 20	20–30	30–40	40–50	50–60	60–70	70–80	80+	
Europe	0	160	800	1,790	760	320	—	—	3,830
Percentage	—	4.0	21	47	20	8	—	—	
Asia	2,500	2,180	2,780	1,840	2,440	2,020	2,160	1,820	17,740
Percentage	14	12.2	15.6	10.4	13.8	11.5	12	10	
Africa	—	—	—	—	830	1,460	6,880	1,910	11,080
Percentage					7.5	13	62	17	
N. and Central America	2,400	1,360	1,200	1,360	1,140	1,500	320	70	9,350
Percentage	25.1	14.6	13.4	14.6	12.2	16	3.4	1	
S. America	—	—	170	340	470	1,460	3,300	1,420	7,160
Percentage			2.4	4.8	6.6	20	46	20	
Australia	—	—	—	40	240	1,180	1,140	360	2,960
Percentage				1	8	40	39	12	
Greenland	510								510
Antarctica	3,670								3,670
Total	9,080	3,700	4,950	5,370	5,880	7,940	13,800	5,580	56,300
Percentage	16	6.6	8.8	9.5	10.4	14.1	24.5	9.9	

The total areas by continents in the two most favorable temperature belts (40°–60°) are as follows:

1. Asia . . . . . 4,280,000 square miles
2. Europe . . . . . 2,550,000 " "
3. North America . . . . . 2,500,000 " "
4. Africa . . . . . 830,000 " "
5. South America . . . . . 810,000 " "
6. Australia . . . . . 280,000 " "
7. Antarctica . . . . . nil

The dominant position taken by Asia is to some extent paralleled in Huntington's world map of "The Distribution of Human Energy on the Basis of Climate."[7] But however energetic a race may be it has not much chance in the struggle for existence if natural resources are wanting. When agricultural and mineral resources are also considered, it is seen (Fig. 8) that the greater part of Asia has a poor future.

We may now estimate the influence of this distribution of temperature belts on the density of white settlement. This can only be obtained empiri-

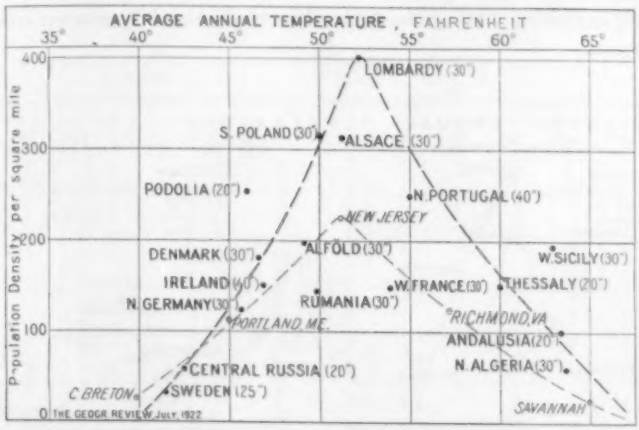

FIG. 3—Graph showing the relation between temperature and density of white population. The heavier line shows values for the European plains, coal-producing regions being omitted: the lighter line for the eastern coast of North America.

cally from data relating to the sole region where European settlement is fairly dense, that is in Europe itself.

The densest populations in Europe are distributed along the coal belt from southern Wales to Silesia. Here temperature is obviously not the main factor. Another obvious control—in this instance tending against settlement—is elevation, though here temperature is concerned as well as absence of good soils and difficulty of communications. With these two controls eliminated we find the temperature effect least complicated by other factors, that is in the *lowland regions where no coal is present.*

In Figure 3 I have charted the temperatures and population densities of almost all the plains in Europe, from the south of Sweden and central Russia with an average temperature of 42° F. to Andalusia and Algeria (which is settled by Aryan peoples) with a temperature of 63° F. These seventeen regions with one notable exception, Western France, lie fairly closely to a cuspate curve. It is to be noted that the rainfall is much the same in all these localities, from 20 to 30 inches, except in Ireland and Portugal.

[7] Huntington, *op. cit.*, p. 142.

There are, of course, considerable differences in some of the minor controls, for instance the facilities for communication and the scale of living. But, all things considered, I believe a large enough number of examples has been investigated to establish the general truth of the conclusion that a mean annual temperature of 53° F. is near the optimum for close European settlement.

On the eastern coast of North America a similar optimum occurs, though here the density of population is naturally inferior. A graph for this region is also shown in Figure 3, and it will be seen that it has much the same limits and optimum. Here the rainfall factor is nearly constant from north to south.

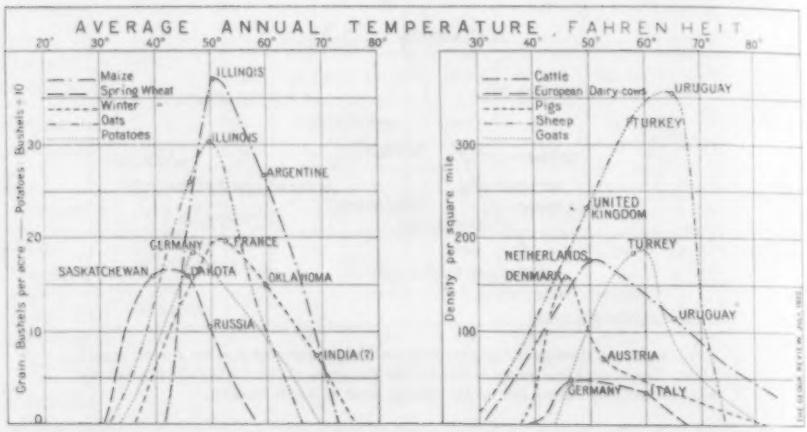

FIG. 4—Graphs showing the temperature control of production of various food crops and of stock raising. (Production data and densities from Finch and Baker.)

The temperature factor is of course variable in itself, notably as regards the annual range. While the average annual temperature is a fair criterion in general, exception must be made in the case of northern and central Asia and northern North America. Here the mean annual range exceeds 50° F. (Fig. 2), and the summer growing season is much more favorable than the annual average temperature would indicate. The summer is equal to that of many countries with an annual temperature 5° higher. I have therefore taken this into consideration, as is noted later.

Other direct controls of settlement—depending on pastoral and agricultural pursuits—may also be graphed in terms of temperature. I have found that data given in Finch and Baker's "Geography of the World's Agriculture" of great assistance in drawing up the graphs given in Figures 4–6.

The temperature controls for the main European and United States food crops of Europe and Canada and the United States are somewhat as follows. Barley grows in regions with an average annual temperature as low as

30° F. Oats, wheat (in Canada), and potatoes are also possible in such countries if the summer is relatively hot, i.e. the climate continental. The optima for barley and Canadian wheat are near 40°; for oats and potatoes near 45°; for maize in the United States near 49°; and for European wheat 51° (Fig. 4). These crops have little relative importance in regions above 60°, except the Indian wheats. It is worth noting that central Queensland, eastern Brazil, Yucatan, and Rhodesia are all regions where the climate would seem to be suitable for this winter wheat crop.

It is obvious that the temperature belt from 35° to 60° is that most favorable to grain crops (Fig. 6). However, the closest white agricultural

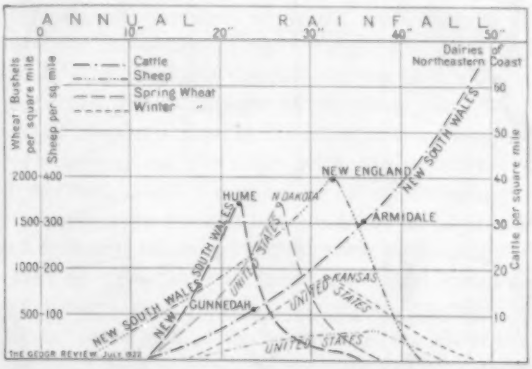

FIG. 5—Graph showing rainfall control of crop production and stock raising in New South Wales (heavier lines) and the United States (lighter lines). The curves are somewhat generalized, and it should be noted that the wheat maximum for the United States is for a whole state (Kansas), but in New South Wales for one county only.

settlement does not occur in the open prairie lands but in the mixed farming country, where the optimum temperature is distinctly higher.

The lower limit for stock is also about 30° F., sheep raising being carried on in regions with this temperature. Cattle are not much in evidence in regions below 35°, and pigs and goats about 40° (Fig. 4). According to the data in Finch and Baker's charts, the optima are somewhat as follows: pigs at 45°, cattle at about 50°, goats at 56°, and sheep at 65°. Cattle, excluding dairy cattle, range importantly through the tropics, but the other stock are not of much importance above 70° F.

RAINFALL CONTROL

If temperature is the most important control, rainfall is easily the next most important; and, if one were ignoring the race aspect, it would rise to the chief place among the physical controls of settlement.

The lower limit of important settlement can be placed at about 15 or 20 inches of rainfall per annum. In certain favored regions, where the rainy

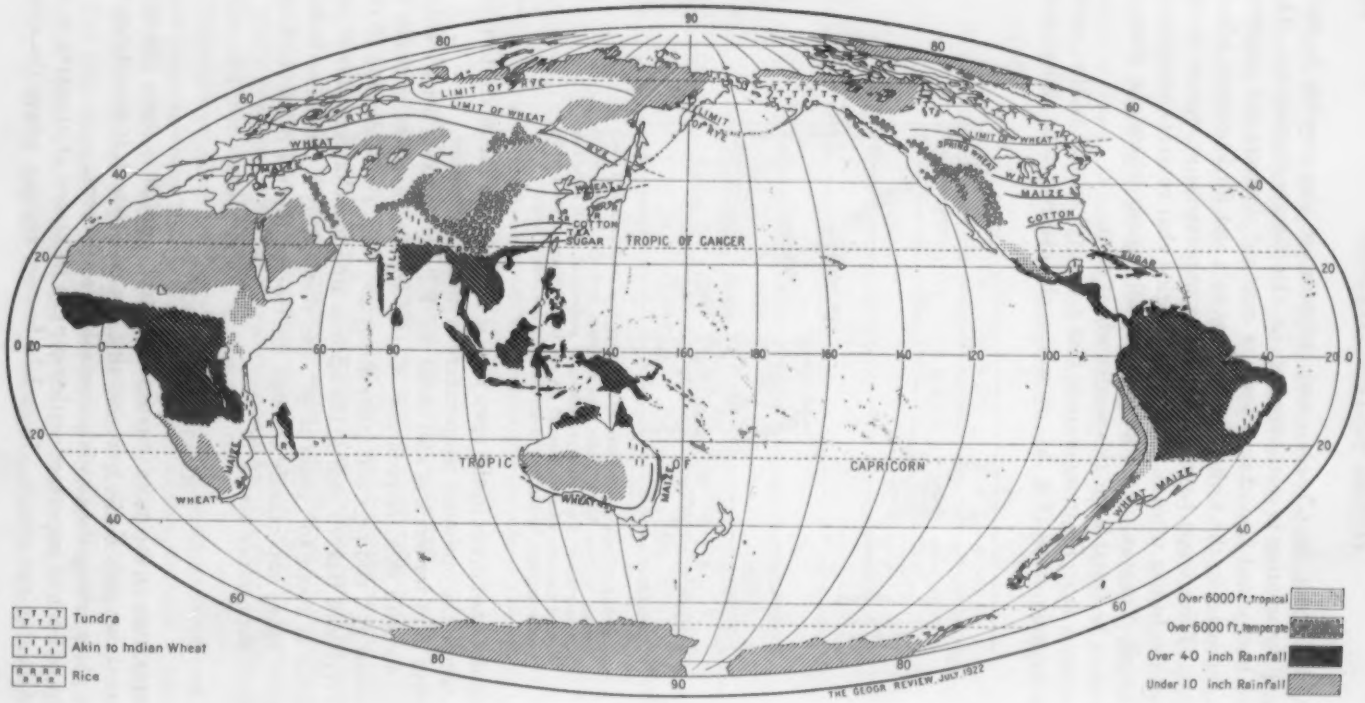

FIG. 6—Map showing in generalized form regions suitable for white settlement and crop zones of the temperate lands. Shaded areas (ruled or dotted) are largely unsuitable for white settlement.

season is very reliable and where the rain falls just at the right time, it is possible to grow wheat successfully with a rainfall as low as 10 or 12 inches. This is the case, for example, in a narrow strip of country in Western Australia, South Australia, the Mallee of Victoria, and also in parts of Oregon and the High Plains of Texas. The optimum rainfall for European settlement appears to be anywhere from 40 to 50 inches. The lower rainfall is adequate in cooler regions; the higher is not too much in regions where the evaporation is very rapid, unless it is somewhat concentrated in the summer months when the wet bulb readings are too high for comfort, as is the case for instance in Brisbane. A rainfall of over 60 inches is generally a disadvantage, though we may note such exceptions as the heavy seasonal rainfall of certain tropical regions—portions of India and Mexico, for instance—where water is stored for use in a long dry season.

In Figure 6 I have plotted the rainfall control as it affects settlement in southeastern Australia about latitude 34° S. Here there is a very uniform decrease in rainfall from 50 inches at the coast to 8 inches near Broken Hill. Dairy cattle are densest on the coast with the maximum rainfall, while cattle are unimportant in the region below 12 inches. Sheep reach a maximum density at about 32 inches, but range from 42 inches downwards. Wheat is grown between 12 and 28 inches, with a maximum at 22 inches.

It is important to note that the great cattle and sheep regions are not those semi-arid districts usually so designated in Australia, but that by far the greater number are reared in the wetter regions, where their importance is apt to be lost sight of among the many other occupations of the settlers. As regards the vast arid expanses of Australia with a rainfall below 10 inches, only a very small percentage (i.e. about two or three per cent) is grazed there, and it will never bulk importantly among the pastoral regions of the world. Similar conditions obtain in the other arid regions.

World Agriculture

From the point of view of white settlement there are four types of land surface which are unsuitable. These are the tundras of the polar regions, which are too cold for our ordinary domestic animals and also usually too dry (development of a large-scale reindeer industry remains to be seen). Secondly, and most important, the desert regions of the world, which are too dry for agriculture though a certain amount of stock can live therein. Thirdly, the rugged mountainous regions and the high plateaus of the colder belts. In tropical regions, of course, the plateaus are much more favorable for settlement, but unfortunately they are not very extensive. Huntington, however, believes that most tropical plateaus suffer from the excessive monotony of their climate.[8] The healthy *variety* of temperate regions is absent. On the other hand, Dr. Bowman writes concerning the tropical

[8] See, for instance, his article, "The Relation of Health to Racial Capacity: The Example of Mexico," *Geogr. Rev.*, Vol. 11, 1921, pp. 243–264.

plateaus:[9] "I was very much surprised to find that there are two distinct seasonal climaxes, one at the height of summer and one at the height of winter; and for the plateaus of Peru and Bolivia these climaxes endure for a period of about six weeks, with very important effects upon the life of the region." Fourthly, there are the hot wet regions of the tropics, whose natural resources are abundant but whose climate is quite unsuited for close white settlement or indeed for any white settlement requiring constant manual labor.

In Figure 6 these four types are given in a generalized form. Here the regions left blank are those suited for European settlement of some sort. Almost the whole of Europe and North America is available, about half of Asia and Australia, and relatively small proportions of Africa and South America.

In the moderately watered tropical regions a considerable population of *pastoral* whites will probably develop. In my opinion there is no prospect of a large agricultural settlement there. In temperate regions I have inserted the zones where the most important crops thrive.

In the northern hemisphere the zones, like the chief mountain ranges, run for the most part from east to west. These zones are broken by the arid and mountainous regions. In the southern hemisphere the trend lines of the continents run north and south. The crop belts more or less agree with this direction. In no case does the crop region extend to the desert areas, but a belt of stock country always occupies the margins of the desert.

The optimum of the wheat crop is near the optimum of white settlement in northern lands. In southern lands the present wheat optimum—in easily tilled prairies—is on the arid side of the optimum of white settlement.

Coal Control

Coal has been described as the "mother of industry." There is no doubt that the great industrial settlements will remain for many generations where power is cheap. The mobile hydro-electric power is not likely to be a serious rival of coal, except for certain specialized industries, for very many years.

The most striking feature of the world distribution of coal is the way in which all the major reserves are clustered along or near the 50° isotherm.[10] This coincidence may indicate that the climates of past ages have on the whole not varied very largely, and that the coal-forming vegetations grew under warm temperate conditions. Probably our present world temperatures are rather lower than usual—for we are living in the later stages of the Pleistocene Ice Age.

The total coal reserve—so far as is known at present—is approximately $7{,}937 \times 10^9$ tons.

[9] Letter to the author.

[10] In 1913 the Geological Congress at Toronto arranged for a survey of the world's reserves of coal. I have used the ensuing volumes very freely in this section of the paper.

Of this colossal amount almost 90 per cent occurs in the seven countries given below:

United States	$3{,}838 \times 10^9$ tons
Canada	$1{,}234 \times 10^9$ tons
China	995×10^9 tons
Germany	423×10^9 tons
United Kingdom	189×10^9 tons
Siberia	173×10^9 tons
Australia	165×10^9 tons
Total	$7{,}017 \times 10^9$ tons

The more one studies the resources of the world the more astounding is the position of the United States. That country is most highly favored in respect of temperature, rainfall, coal—so that the center of the world's industry and of the white population will inevitably move across the Atlantic from Europe to North America.

In the *Fortnightly Review* of February, 1918, "Politicus" discusses the effect of the coal factor somewhat as follows:

> Coal production and the birth rate are closely related; for only where there is cheap power can the densest civilized populations obtain remunerative wages in the many factories dependent on the coal. Hence the so-called "decay of the French nation" is almost entirely due to her poverty in coal and iron, which largely depended on German aggression in 1871. Almost all the growth of German population has occurred in the coal and iron towns, whose expansion has only been exceeded by the western towns of the United States. On the other hand, the German rural population was less in 1910 than in 1871. . . .

Similar results are to be expected in the other coal regions of the world, which makes Table II of vital interest in the question under discussion. In this table I have discussed separately the several well-defined coal fields which occur in some of the countries (e.g. Germany) listed.

It may be objected that we have no accurate knowledge of the geological formations through large areas of the world. This is no doubt true of much of the tropical forest country in Brazil and Africa; but here, as we have seen, close white settlement is not likely to take place owing to climatic disabilities. Much of the tropical deserts and grasslands has been prospected, at any rate to such an extent that the chances of finding a coal field rivaling those of the seven important regions is not probable. For instance, in the great area of arid Australia with hardly an inhabitant, it is safe to say that there is no likelihood of a large coal field anywhere—though some seams may be found in the northwest. When one thinks of the ubiquitous prospector for precious minerals—and of late for oil—it seems improbable that Table II will be materially altered.

I have not thought it necessary to consider other mineral deposits in this world-wide survey. Petroleum is a vital factor in our present day civilization. Distribution of its production must change within a short space of

time,[11] but no great change in settlement is likely to be effected thereby, for oil is a peculiarly transportable product. Iron ore is generally carried to the coal fields. Gold and other deposits do not lead to settlement to the

TABLE II—CHIEF COAL RESERVES OF THE WORLD

(Based on the Reports of the Geological Congress of 1913)

No.	Locality	Tons Estimated x 10^6	Kind of Coal	Remarks
1	United States Northern Plains	1,175,000	Largely lignite	Black Hills and Colorado are bituminous
2	Canada, Alberta	1,000,000	Lignite or soft coal	Bituminous in center; anthracite along west
3	United States, Rockies	1,000,000	Bituminous Anthracite	In Montana In Utah, etc.
4	China, Shansi	714,340	Anthracite	Possibly best field in the world
5	United States, Eastern	500,000	Anthracite	Chiefly Pennsylvania, Ohio, and W. Virginia
6	United States, Central	500,000	Anthracite	Chiefly Illinois and Missouri
7	Germany, Westphalia	212,000	Bituminous	
8	Germany, Silesia	166,000	Bituminous	
9	China, Yunnan, etc.	140,000	Anthracite and bituminous	Also Hunan and Szechwan
10	England (total)	125,000	Bituminous	Carboniferous
11	New South Wales	115,000	Bituminous	Permo-Carboniferous
12	Canada, British Columbia	70,000	Chiefly bituminous	Crow's Nest
13	Canada, Saskatchewan	57,400	Lignite largely	Cretaceous, etc.
14	Transvaal	56,200	Chiefly bituminous	
15	Russia, Donetz	55,000	Chiefly anthracite	
16	India, Raniganj	53,000	Bituminous	
17	Wales	40,000	Bituminous-anthracite	
18	Bohemia	40,000	Bituminous-anthracite	Pilsen and Prague
19	Victoria, Morwell	30,000	Brown coal	Tertiary
20	Colombia	27,000	Bituminous	
21	India, Hyderabad	23,000	Bituminous	
22	Scotland	22,000	Bituminous	
23	United States, Texas	21,000	Lignite	
24	Indo-China	20,000		
25	Germany, Saar	16,000		
26	Siberia, Irkutsk	15,000?		Total reserves in Siberia said to be 173 x 10^9
27	Siberia, Kuznetz	12,500	Chiefly brown coal	
28	Belgium	11,000	Bituminous	
29	France	11,000	Chiefly bituminous	
30	Spitsbergen	8,750	Bituminous	
31	Spain	8,750		

[11] David White: The Petroleum Resources of the World, *Annals Amer. Acad. of Polit. and Soc. Sci.*, Philadelphia, Vol. 89, 1920, pp. 111–134.

same extent that coal does. While the gold discoveries of 1851 accelerated the settlement of Australia, few of the large number of immigrants ultimately engaged in gold mining—they turned to farming, etc. In Australia today it has been estimated that only about 120,000 people dwell in gold fields which are remote from agricultural districts.

Location Factor

We have considered the three major factors determining close European settlement. Of those remaining, soil and communications are perhaps the chief. Both of these depend largely on elevation: almost all the largest areas of good soil and of easy communication are plains below 2,000 feet elevation. Speaking generally, elevation is a disadvantage, for it always implies heavy transport difficulties. Tropical plateaus are an improvement on tropical lowlands for white settlers inasmuch as they come nearer to the optimum temperature; but this is expressed by the temperature scale in our estimate of the value of the region under consideration. We can therefore use a *location scale* ranging upwards from an optimum at sea level and trust to the temperature control to express the healthier conditions of tropical plateaus.

Other Factors

It will be found that almost all the factors influencing human settlement are based on the four considered above. Health is controlled primarily by temperature and humidity—of which the latter is closely related to rainfall. Agriculture is concerned with rainfall and temperature. A rich soil is not vital in these days of fertilizers. Thus in the Australian Mallee and other regions of an extremely sandy nature an addition of superphosphate gives a payable wheat yield. In the future, artificial manures will be of increasing importance; but the natural controls of temperature and rainfall can never be altered.

Irrigated regions are perforce not properly represented in this scheme. Except in Egypt and Mesopotamia they are not likely to build up vast populations in desert countries. In Australia, for instance, the irrigated lands form only one part in ten thousand of those which require more rainfall, and this small proportion will never be sufficiently increased to be of much importance.

Pastoral industries are determined almost wholly by rainfall and not by temperature; for some varieties or other of cattle, sheep, or allied animals range throughout the continents, excluding only the permanent ice caps and the dense tropical forests. Industrial settlement, the great feature of modern life, is dependent essentially on temperature and coal. We have noted that there are practically no coal fields in arid regions.

It is impossible to discuss every factor. Fisheries, which from the most ancient times have been a factor of local importance, are ignored, and they lead to some fairly important populations today.

The psychical factor, for instance the influence of religion and of genius, in determining man's environment is an aspect which does not lend itself to quantitative representation.

The Econograph

The most difficult feature in this research was to compare the values of the four major controls of white settlement. I was only able to arrive at what seems a fairly satisfactory conclusion in regard to the order of importance of the factors of temperature, rainfall, coal, and location by a method of trial and error. The problem may be simplified by considering the effect of location and coal supply first.

The location factor is of much less importance than the other three. As long as the regions are on the average below 1,500 feet or so this factor is not vital as regards communications, etc. Above 1,500 feet a handicap is introduced; but only in a few cases does this factor exert paramount influence over regions, though admittedly it determines certain important ports and junction towns. We may, therefore, for a time ignore the location factor.

With regard to coal it is only possible to see how this factor influences the population of a country by comparing it with an adjoining country not blessed with this asset.

Table III—Influence of Coal on Density of Population

Country Rich in Coal	Small or No Coal Supply	Ratio
Bohemia 315	Hungary 160	1.9
Germany 324	France 191	1.7
Poland 193	Western Russia* 94	2.0
Britain 460	Ireland 140	3.2

* Four adjacent provinces equal in area to Poland.

The above comparisons are by no means exhaustive, and some striking exceptions, such as Italy, can be found; but they serve to show that, under present conditions in Europe, the presence of abundant coal and the resulting industries have about doubled the population in the countries so favored.

We are now faced with the following problem. We have three paramount factors, temperature, rainfall, and coal, which practically control the white settlement of today with the exception of a few mining districts. We have a continent, Europe, where these factors have operated for so long a period that it may be assumed that under present economic conditions the population is distributed largely in direct response to these factors.

I have divided Europe into eight natural regions whose population density varies greatly, from that of the British Isles to that of the Tundra. Assuming that one knew the exact relative values of the factors temperature and

rainfall one could express this as an area (i.e. temperature x rainfall) which could be equated with the population resulting therefrom.

Since the density of population depends directly on the variables temperature and rainfall, the theory of variation tells us that we may use the product, temperature factor x rainfall factor, to represent the density. This can be expressed as an area; and this area (triangle *A B O* in Fig. 7) forms the basis of the empirical graph which I use to compare the seventy-four regions of the world.

My method has been to arrive at the relation of the temperature factor to the rainfall factor by assuming various values and testing them against the actual population map of Europe.

It was logical to start off by giving the optimum temperature and optimum rainfall equal values. Hence a country with an average temperature of 55° F. and an average rainfall of about 50 inches would be represented by a right angled triangle with two sides of equal length. If in addition it had the optimum amount of coal of some 200 x 10^4 tons per square mile, then this triangle would be doubled in area by adding another axis to the right of equal value to the other two.

We may then draw corresponding triangles or quadrilaterals for the eight regions of Europe (using the above dimensions for the optimum values). The areas of the eight figures will stand in a certain relation to each other. If our premises are correct, these areas will be proportional to the actual populations of the regions concerned. If our factors are wrongly related, then the population densities (or isopleths expressing the populations) will not at all agree with the areas of our figures.

This is the method of trial and error which I have used. The "test" areas using equal lengths for the temperature, rain, and coal axes did not give isopleths corresponding to the actual population lines, which should result from the plotting of such axes in the manner described. If, however, the relation shown in Figure 7 be made use of, where the temperature control is given double the weight of the rainfall, while the coal factor, if extremely large, may double the area, then the resultant economic graphs for certain fully developed regions agree fairly with their respective populations.

The writer is prepared for some adverse criticism of this method, but he feels that there is much to be gained by the use of these comparative graphs. He would remind readers that the introduction of a similar method of comparing climates by the climograph[12] has led to a number of interesting papers on comparative climatology, in which moreover useful suggestions for improving this graphic method have been made. The writer hopes for the same happy result from the present paper.

The "econograph" is a rectangular figure formed on four axes which represent, respectively, the average annual temperature, the average annual rainfall, the average elevation, and the (estimated) total coal reserve of the region.

[12] *Geogr. Rev.*, Vol. 4, 1917, pp. 401–403.

The ideal region would have an econograph like that shown in Figure 7. The temperature would be 55° F.; the rainfall 50 inches; the region would be at sea level; and the coal supply 200 x 10^4 tons per square mile. It will be seen that the temperature and rainfall give the triangle *A B O*, while the presence of a large coal supply doubles this by adding the triangle *A O D*. The location effect is shown by the small area below the line *B D*; it is not of much importance save that if a region be mountainous, this area almost disappears.

In the scale used the area of the ideal econograph occupied 1,000 units. All the seventy-four regions were below this ideal, though Britain and North China each totaled 770 units. It is my purpose to show that the area of the econograph represents the habitability of the region as closely as one can expect to assess it in the present state of our knowledge.

In Table IV I have recorded the economic factors. The first column gives the area of the region. The next four columns can be used to plot the econographs according to the scales on the ideal graph.

Variation of the shape of the econograph may be studied with profit. A symmetrical graph, like that of Britain, indicates that a region is well equipped for agricultural or industrial occupations. If only the left side is present, it is chiefly an agricultural or pastoral region, e.g. Central Russia. In a few cases the right side predominates, as in the Utah region, which means that the coal reserves are likely to be of greater value than the agricultural resources. Where the lower triangle (below the horizontal axis) is large the region possesses extensive lowlands and is likely to have large areas suited for intense cultivation, e.g. Southern Russia. Where it is small the country is elevated and usually not well suited for agriculture, e.g. Norway.

Somewhat similar indications are given by the length of the diagonals (or axes). If the upper axis is long, then the region will have a comfortable climate, e.g. Britain or Southern California; and if it be short, the converse is the case, e.g. Norway or most tropical regions. A short axis to the left is unfavorable for white farming but is often suitable for a pastoral occupation. A wet mountainous region, where hydro-electric energy is usually plentiful, is shown by a short lower axis combined with a long axis to the left, e.g. Southern Chile. The desert regions have a characteristic elongated shape ranging from the moderately arid type, such as Southern California, to the almost entirely useless types of the Tundra or the Thar.

World Isoiketes

If now the numbers representing the areas of the regional econographs, and thus the habitability of the regions, be plotted on a map of the world (as in Fig. 8), we can draw lines through the numbers and form a sort of contour map. To such a line I gave the name "isoikete" (from οἰκητός, habitable).[13]

[13] *Geogr. Rev.*, Vol. 8, 1919, p. 112.

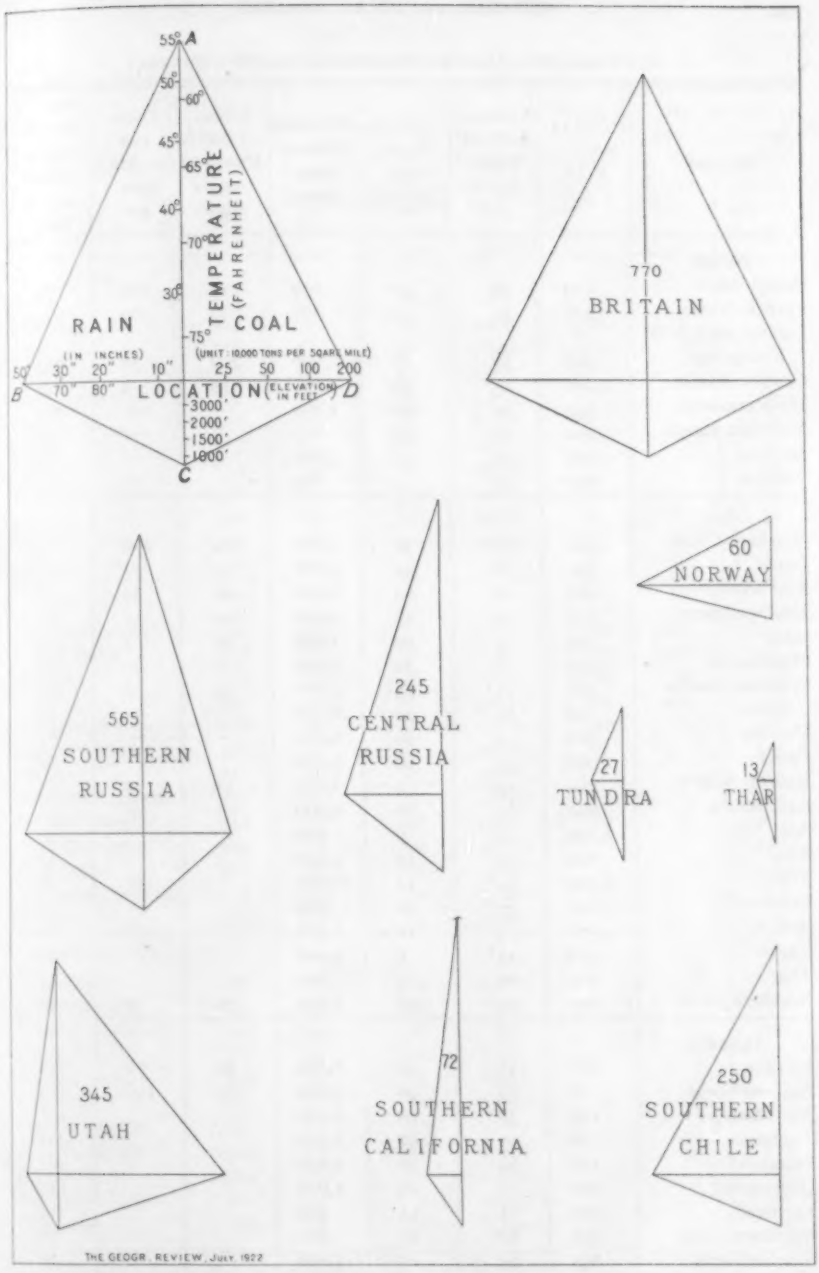

FIG. 7—**The standard or ideal econograph and examples of its application. The econograph is an empirical graph based on the four major controls of settlement. Its area is approximately proportional to the habitability of the region concerned which for the ideal region is taken as 1000 units. The standard graph is represented above by the figure *A B C D* (the crossing of the axes of the coördinates is the point *O*). Figures within the regional graphs show the area and thus the relative habitability of the regional illustrations shown.**

TABLE IV—ECONOMIC FACTORS OF THE REGIONS

REGION	AREA (square miles x 10^2)	AVERAGE ANNUAL TEMP. (degrees F.)	ANNUAL RAINFALL (inches)	AVERAGE ELEVATION (feet)	TOTAL COAL RESERVE (tons x 10^6)	COAL PER SQ. MILE (tons x 10^6)	AREA OF ECONOGRAPH (1,000 units = max.)
Europe							
British Isles	120	50	40	600	190	160	770
Franco-Prussia	422	50	30	600	250	60	620
Poland (with S. W. Russia, etc.)	400	50	28	600	200	50	565
Central Russia	1,200	45*	20	600	55	4	245
Mediterranean	545	60	20	1,500	—	—	210
Northern Russia	461	38	15	600	—	—	65
Norway	125	28	38	3,000	—	—	60
Tundra	600	29*	9	600	—	—	12
Asia							
Northern China	360	55*	30	1,500	714	200	770
Japan	300	55	40	2,000	—	—	484
Southern China	588	68	65	2,000	140	24	288
Mediterranean	158	60	18	3,000	—	—	180
Siam	750	75	60	1,000	20	3	136
Manchuria	940	30*	20	1,500	—	—	120
Western Siberia	768	35*	15	600	13	2	120
Ceylon	25	80	30	1,500	—	—	78
Deccan	588	75	20	1,200	—	—	72
Persia	1,000	55	10	3,000			66
Eastern Siberia	740	30*	12	2,000	15	2	45
East Indies	800	80	80	2,000	—	—	43
Aral	1,100	50*	6	600			40
Altai	820	30*	15	4,500			35
Tibet	2,100	30*	12	12,000	—	—	30
Tundra	3,220	20*	10	600	—	—	27
Arabia	1,372	75	10	1,500			20
Tarim	750	55*	6	3,000			20
Thar	263	80	5	600			13
Northern India	870	75	40	1,000	76	9	140
Australia							
Victoria	172	55	30	1,000	30	18	575
Eastern Coast	98	65	40	2,000	115	110	574
New Zealand	104	50	50	2,000			430
Tasmania	26	50	40	1,200			400
Swanland	172	60	20	1,000			225
Queensland	282	73	25	1,000			143
Lachlan	245	65	15	500			119
Northern Coast	578	80	25	800			70
Southern arid	835	65	7	1,200			40
New Guinea	343	77	100	2,000			21
Northern arid	565	75	9	1,000			16

* Temperate region with hot (continental) summer; 5° F. added on econograph axis.

TABLE IV—ECONOMIC FACTORS OF THE REGIONS (*continued*)

REGION	AREA (square miles x 10^3)	AVERAGE ANNUAL TEMP. (degrees F.)	ANNUAL RAINFALL (inches)	AVERAGE ELEVATION (feet)	TOTAL COAL RESERVE (tons x 10^4)	COAL PER SQ. MILE (tons x 10^4)	AREA OF ECONOGRAPH (1,000 units = max.)
Africa							
Natal	140	60	30	3,000			300
Transvaal	264	62	20	3,000	56	21	273
Cape	128	59	20	1,500			225
Rhodesia	1,250	72	40	3,000			180
Madagascar	227	72	40	1,500			136
Algeria	390	68	20	2,000			125
Congo	1,587	78	70	1,000			76
Uganda	770	75	30	3,000			68
Sudan	2,080	79	35	1,500			65
Kalahari	500	63	8	3,000			48
Northern Sahara	2,466	68	20	1,000			16
Southern Sahara	1,338	78	5	1,000			10
North America							
Northeastern states	747	50	35	1,000	1,000	135	755
Inland plains	592	60	20	2,300	1,175	200	675
Alberta	630	40*	15	2,500	1,000	170	420
Utah	250	45	10	5,000	500	200	345
Southeastern states	486	65	40	1,000	21	4	326
Eastern Canada	960	40*	27	1,000			315
Oregon	246	55	25	3,000			315
Southern Rockies	510	65	12	5,000	500	100	300
British Columbia	345	38	40	2,500	70	20	286
Central America	592	70	60	3,000			165
West Indies	100	78	50	1,000			120
Southern California	444	63	10	2,000			72
Tundra	1,910	15*	12	1,000			15
South America							
Uruguay	750	65	35	1,000			315
Southern Chile	131	45	70	3,000			272
Western Argentine	525	60	20	800			210
Central Chile	78	55	15	3,000			184
Andean plateau	525	63	15	8,000			112
Colombia	945	78	40	1,000	27	3	95
Central Brazil	1,820	78	70	1,000			91
Eastern Brazil	328	75	25	1,000			78
Amazons	1,969	80	80	500			65
Northern Chile	210	60	3	5,000			60
Patagonia	78	45	10	1,200			45

* Temperate region with hot (continental) summer, 5° F. added on econograph axis.

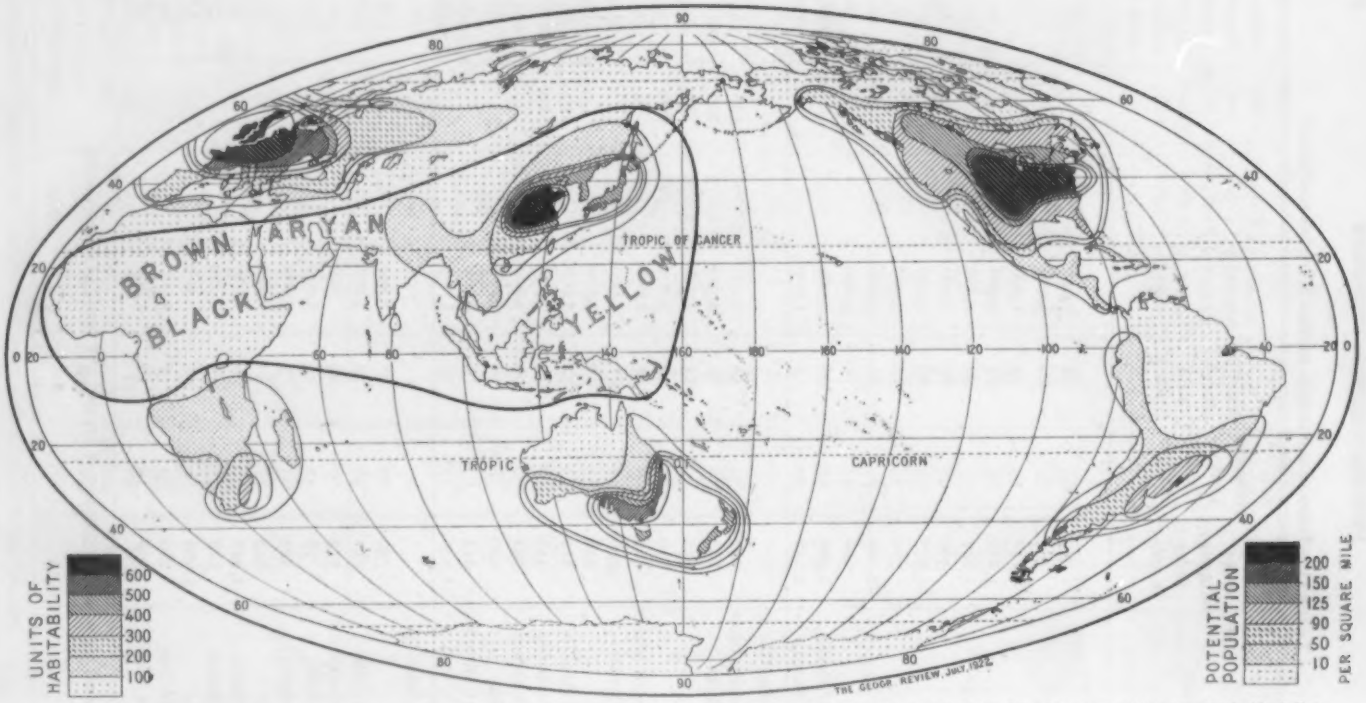

FIG. 8—The distribution of future white settlement according to the economic value of the world regions (see Fig. 1 and Table IV). The area within the heavy black line is not available for white settlement but has been treated uniformly here. The facts of the distribution shown in this figure may be expressed by degree of habitability, shown by "isoiketes" (see legend to the left) where the optimum of habitability is 1000, or by the corresponding potential population density (see legend to the right).

Figure 8, drawn in this fashion, presents many points of interest. There are three first-class centers of (white) habitability, two of the second class, besides many areas in North America around the major centers. These are shown in Table V.

TABLE V—POTENTIAL REGIONS OF CLOSE WHITE SETTLEMENT

CLASS	UNITS OF HABITABILITY, 1000 = max.	REGION AS DEFINED IN FIGURE 1	PRESENT SETTLEMENT
I	770	British Isles	Closely settled
	620	Franco-Prussia	Closely settled
	770	Northern China	Not available for whites
	756	Northeastern states of the United States	Moderately settled
	675	Inland plains of the United States	Sparsely settled
II	565	Poland, Austria, etc.	Closely settled
	575	Victoria (Australia)	Moderately settled
	565	Eastern coast of Australia	Moderately settled
III	484	Japan	Not available for whites
	430	New Zealand and Tasmania	Sparsely settled
	420	Alberta	Sparsely settled
IV	315	Uruguay	Moderate settlement
	300	Natal	Moderate settlement (not wholly available)
	345	Utah	Dry, sparsely settled
	326	Southeastern states of the United States	Moderately settled
	315	Eastern Canada	Sparsely settled
	315	Oregon	Sparsely settled
	300	Southern Rockies	Dry, sparsely settled
V	286	British Columbia	Sparsely settled
	288	Southern China	Not available for whites
	250	Southern Chile	Sparse
	245	Central Russia	Fairly close settlement
	225	Swanland	Sparsely settled
	213	Transvaal	Sparsely settled
	210	Western Argentine	Sparsely settled
	210	Mediterranean	Closely settled

The first eight regions (Classes I and II) in Table V are all endowed with a plentiful coal supply. In the third class come two regions, Japan and New Zealand, with poor coal supplies but excellent climatic controls. The enormous coal supply of Alberta is balanced by its long winter, so that it appears rather low down amid the most attractive regions.

TABLE VI—Regions of Potential Moderate White Settlement

Class	Units of Habitability	Region	Remarks
VI	180	Rhodesia	Sparsely settled
	180	Anatolia	Largely occupied
	168	Central Chile	Largely occupied
	165	Central America	Largely occupied
	143	Queensland	Sparsely settled
	140	Northern India	Not available
	136	Siam	Not available
	136	Madagascar	Not available
	125	Algeria	Largely occupied
	120	Western Siberia	Sparsely settled
	120	West Indies	Largely occupied
	120	Manchuria	Not available
	119	Lachlan	Sparsely settled
	112	Andean plateau	Largely occupied

In this class Rhodesia, central Queensland, Western Siberia, and the Darling Basin offer large areas for settlement which may be used for ranching or, in places, for dry farming.

The remaining regions of the world comprise the tundras, deserts, and hot wet countries where even moderate white settlement is unlikely. A considerable development of the pastoral industry with sparse white settlement is of course probable in the more favorable areas.

Table VII—Approximate Density Values for Econograph Areas

Econograph Area	Population Density per Square Mile
600 units	200
500	150
400	125
300	90
200	50
100	10

Europe As a Criterion

The only large region where white settlement has taken place for centuries is of course the continent of Europe. From all the European countries emigration has removed the surplus populations; and, though we cannot describe the continent as "saturated," it is the only one which approaches that condition.

In Figure 9 is shown the theoretical distribution of population in Europe by isoiketes compared with the present actual distribution. We see at once that

there is a strong resemblance between the isoiketes and the population lines. Both center about London from whence they form concentric loops about an axis reaching to Western Siberia. The 100 isoikete agrees quite closely with the 10 population line if the latter be inserted between the 2 and 26

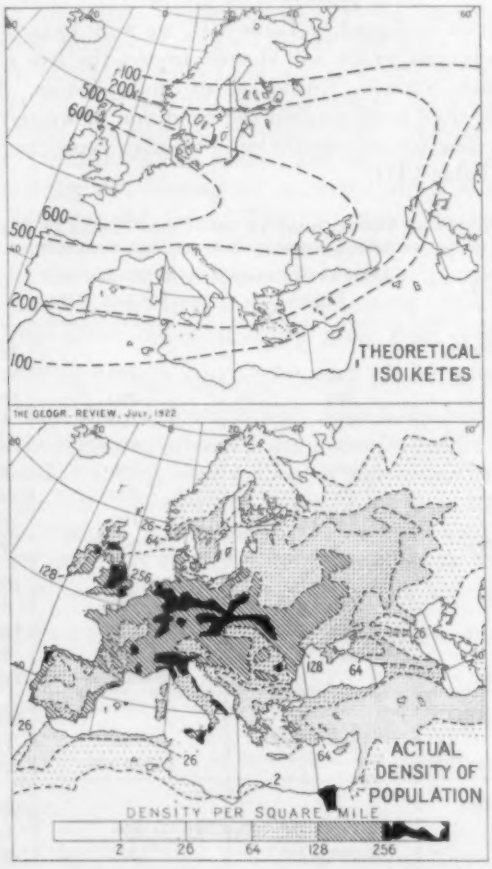

FIG. 9—The actual population density of Europe compared with the theoretical isoiketes (lines of "habitability").

lines. In the same way the 200 isoikete agrees fairly with the 50 population line, if it be inserted. The 500 isoikete is near the 150 population line, and the 600 isoikete is not far from the 200 line except in Galicia.

Plotting on a graph the European density of population and its corresponding isoikete, we can interpolate for the regions of moderate habitability, which do not occur in Europe. This gives us Table VII.

Using these factors we can arrive at a probable answer to the question,

"How will the white population of the world be distributed when the empty continents are occupied to the extent that Europe is at present?"

Conclusions

Distribution of Population

Using the ratios indicated in Table VII, we may hazard an estimate of the white populations which will cluster around the five world centers of Chicago, London, Sydney, Buenos Aires, and Durban. When the surrounding region shall have reached the condition of western Europe (with a density exceeding 100 per square mile) we may expect populations of the order given in Table VIII.

Table VIII—Potential Populations in the Chief Areas of White Settlement

Region (Fig. 1)	Area in Square Miles	Estimated Density per Square Mile	Total Population
North American Regions			702 millions (52%)
Northeastern states	747 x 10^3	400	298
Inland plains	592	200	118
Alberta	630	100	63
Utah	250	100	25
Southeastern states	486	100	48
Eastern Canada	960	100	96
Oregon	246	100	24
Adjoining regions		below 100	30
European Regions			386 millions (29%)
Britain	120 x 10^3	500	60
Franco-Prussia	422	300	126
Poland, etc.	400	200	80
Adjoining regions		below 100	120
South American Regions			115 millions (8.5%)
Uruguay, etc.	750 x 10^3	100	75
Adjoining regions		below 100	40
South African Regions			82 millions (6%)
Natal	140 x 10^3	100	14
Rhodesia	1,250 x 10^3	(40)	50
Adjoining regions		below 100	18
Australian Regions			62 millions (4.5%)
Victoria	172 x 10^3	180	29
Eastern coast	98 x 10^3	180	18
Adjoining regions		below 100	15

The total of these regions is 1,347,000,000. Distributed according to political control we have 377,000,000 (28 per cent) in the British Empire, 513,000,000 (38 per cent) in the United States, 457,000,000 (34 per cent) in other countries.

Conurbations

Assuming that an adequate food supply is forthcoming, we may briefly consider how these vast populations will settle in the five major areas.

Professor Geddes, who looks forward to a period of more orderly design, has pointed out that in the British industrial regions the cities at present merge into great "disorderly conglomerations."[14] In England, for instance, there are two great clusters, "Greater London" and what he terms "Lancaston." The latter, extending from Liverpool to Leeds, is already 100 miles wide. He points out that five other conurbations are arising. These are the Scottish center (Glasgow-Edinburgh), the Newcastle center, the Sheffield center, the Birmingham center, and the South Wales center.

Lille and Essen are two continental examples which in the near future will unite via Antwerp and Liége. The Pittsburgh district is a forecast of the intense settlement which will arise in the eastern United States. Even in Australia the rise of such towns as Cessnock (4,000) within the last few years points to a conurbation around Newcastle. This will unite with Sydney and spread down the coast to the great Bulli coal field.

Food Supply and Population Increase

Where is the food coming from to feed these industrial centers? Most people know of the huge granaries of Russia, the United States, India, etc., but fail to realize that already their huge populations permit of only limited export—before the war only about one-sixth of the total wheat production of each of these countries was exported (Table IX). Canada, Argentina, and Australia are exporting considerable percentages at present; but how long can this be maintained in the face of their own growing populations?

Table IX—Chief Wheat-Exporting Countries, Average Production and Export 1911–1913*

(*In millions of bushels*)

	Production	Export
Russia	727	128
United States	705	116
Canada	229	111
Argentina	156	101
India	370	60
Rumania	88	54
Australia	89	52

* G. B. Roorbach: The World's Food Supply, *Annals Amer. Acad. of Polit. and Soc. Sci.*, Philadelphia, Vol. 74, 1917, pp. 1–33. See also J. Russell Smith: The World's Food Resources, New York, 1919.

It has been estimated that before the war the United Kingdom and Belgium produced only 53 per cent and 57 per cent of their respective food requirements. To a less degree Germany and even France were dependent on outside sources. The closely settled regions of the East—India, China

[14] Patrick Geddes: Cities in Evolution, London, 1915.

and Japan—also are already anxious as to future food supplies. It is indeed a vital problem for the world as a whole and is of more immediate interest than most people realize.[15]

Let us consider the North American region of settlement with its potential 700 millions. The population of the United States has been doubling itself approximately each thirty years during the last century. It was 25 millions in 1850, 50 millions in 1880, and 100 millions in 1910. If this rate of increase continue, it will have grown to 700 millions in less than 100 years!

The world as a whole has doubled its population during the last ninety years. If the rate for North America drops to this figure, then it will take about 270 years to reach 700 millions.[16]

If we consider the time which it will take the Australian population of 5 millions to grow to 62 millions we find that it amounts to 100 years on the more rapid rate—which obtains at present—and to 320 years on the slower rate. These are much the same periods as deduced for the United States.

The Commonwealth Statistician (G. H. Knibbs) concludes his voluminous report on the 1911 census with the following pertinent remarks (p. 455):

> The earth's population may be taken . . . as 1,500 millions and its land area (excluding Polar regions) at 33,000 million acres. If we could raise 22.8 bushels of food corn per acre per annum, the total yield would only be 752,400 million bushels. The food consumption (per person) per annum is about equivalent to 5.7 bushels—which on the above computation would feed 132,000 million people.
>
> At the rate of increase of population of 0.01 per annum (somewhat less than the rate for all countries which have accurate statistics), it would require only 450 years to exhaust the food requirements mentioned. . . . The fundamental element in Malthus' contention is thus seen to be completely established.

I have shown what I deduce to be the distribution of the white peoples during the next two centuries. According to it we may expect an increase of 600 millions gradually to occupy North America; 100 millions in South America, and over 50 millions in southeastern Australia and also in South Africa. The future of the Indian and colored races I have not attempted to discuss in this paper. Already they amount to over 1,000 millions, and one can hardly estimate their increase in numbers in two centuries; for with the spread of sanitation and of law and order the natural increase of population throughout Africa and Asia is not likely to diminish.

Yet a general decline in the birth rate would seem to be the only answer to the statistical argument which I have quoted. It is difficult to imagine a crop (at present unknown) more valuable than wheat, and covering every acre of land surface. A vast world struggle between higher civilizations with a low birth rate and lower civilizations with a high birth rate seems to be foreshadowed. This would seem to be inevitable within the next two centuries if the white race is to maintain its dominant position.

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[15] On the general problem see M. Aurousseau: The Distribution of Population: A Constructive Problem. *Geogr. Rev.*, Vol. 11, 1921, pp. 563–592.

[16] Compare E. M. East: The Agricultural Limits of Our Population, *Scientific Monthly*, Vol. 12, 1921, pp. 551–557.

MILITARY METEOROLOGY*

By WILLIAM GARDNER REED
Formerly Major, Signal Corps, U. S. A.

Since very early times the influence of the weather on military operations has been of great importance, and success or failure has many times been the direct result of weather conditions. But, because the scientific application of meteorology and its organization on a comprehensive scale are of recent development, modern military meteorology had its origin in the late war.

In the summer of 1917 it became evident that meteorological personnel and equipment were required by the American Expeditionary Forces in France. The interest of American meteorologists was aroused,[1] and arrangements were made to provide for the meteorological needs of the American armies in the field. Ideas as to the part meteorology played in the prosecution of war and as to the duties of meteorological personnel were, however, still very hazy, and actual work with the French and British armies was necessary to show how the meteorological units functioned. The actual day-to-day work began in April, 1918; and from that time until some months after the Armistice the meteorological work of the French, British, and American armies was carried on with cordial co-operation and mutual understanding. This account is an attempt to record some of the lessons learned.

THE MILITARY FACTOR

The military side of military meteorology cannot be neglected, although this phase of the matter, which looms so large in actual experience, can here have only passing attention. The reason for speaking of it here is that it is of vital importance in the selection and assignment of meteorologists for active military duty. Unless the meteorological officer in the field can handle his men, procure quarters and food for them, get his equipment, secure communication and transport service, and in general fit himself and

* It is a pleasant duty to acknowledge my great obligation to Lieutenant Colonel William R. Blair, Signal Corps, U. S. A., Officer in Charge, Meteorol. Sect., Sig. C., A.E.F., under whose command and guidance I studied and practiced military meteorology in France and Germany in 1918 and 1919. I also acknowledge the assistance of the other officers and the enlisted men of the Meteorological Section.

[1] Several papers dealing with phases of military meteorology and with the meteorological service of the United States Army have appeared from time to time in the *Monthly Weather Review*. Reference may be made, for instance, to R. A. Millikan: Some Scientific Aspects of the Meteorological Work of the United States Army, Vol. 47, 1919, pp. 210–215; B. J. Sherry and A. T. Waterman: The Military Meteorological Service of the United States During the War, *ibid.*, pp. 215–222; H. G. Lyons: Meteorology During and After the War, *ibid.*, pp. 81–83. See also M. M. Welch: Recent Publications Relating to Military Meteorology, *ibid.*, Vol. 46, 1918, pp. 40–41.—EDIT. NOTE.

his command into the tactical organization with which he is associated, no amount of ability as a meteorologist will avail anything. Furthermore, he must understand the methods and problems of the officers charged with the development of the tactical situation or he cannot make his services as a meteorologist count in the prosecution of the war.

From a tactical point of view it is probably desirable to divide military meteorology into that applying to permanent positions, for instance coast defense commands, and that applying to mobile armies, best exemplified by an expeditionary force on foreign soil. The meteorological problems, however, are not widely different. The general problems of military meteorology are best exemplified by the requirements of an expeditionary force; because, while the meteorological problems of such a force can readily be applied to fixed positions, the conditions under which an expeditionary force operates, or is likely to operate, set limits to the methods employed.

Military meteorology falls into three rather clearly defined parts:

1. Statistical information, or past weather.
2. Current information, or present weather.
3. Forecasts, or future weather.

Statistical Information

Statistical information includes the mass of meteorological data which may be available for the region in question. Such information is valuable in connection with many military installations of a more or less permanent character and with the distribution of *matériel* and personnel, whether among training stations or on the battle front. In connection with statistical meteorology it may become necessary in the case of an expeditionary force to procure the information desired indirectly from observations on the character of plants, stream courses, etc. When an expeditionary force is being organized the meteorological officers attached to this force should accumulate as much information as possible regarding the conditions in the regions to which the force is to be sent. It is a question just how many data should be carried into the field. Field conditions do not readily lend themselves to transportation of voluminous records. On the other hand, the accumulation of material at the base in the home country is not of great value, owing to the fact that communications between the home base and the expeditionary force are apt to be overcrowded, and therefore the material accumulated is not readily accessible to officers in the field.

Statistical meteorology should be studied to such an extent that the meteorological officers can give definite information with regard to the important questions which are likely to arise. These questions will certainly concern such matters as the clothing and equipment of troops necessitated by the usual meteorological conditions. Extreme conditions are of less importance because a considerable amount of suffering by men and animals and serious disarrangement of transport by possible but not very probable

conditions must be expected in the case of any such expedition. The necessary preparation for expectable conditions will usually require all the energy of the general staff and impose such a strain upon communications with the home base that additional equipment to provide for unusual though possible conditions is not likely to be considered. Statistical meteorology will give such information as the probability of snow cover and the extent of such cover, the time of loss of leaves from trees or the changes in color of leaves, and similar matters of equal importance in these days of camouflage. It will show the time of freezing of rivers, important from the point of view of navigation and water supply as well as from that of transportation upon the ice. The probability and times of occurrence of snow and mud conditions with the resulting necessities of radical changes in transport methods will be shown by a proper study of the statistical records.

Before the medical department of an expeditionary force can make adequate arrangements for the care and transportation of the sick and wounded, or determine the number, design, and location of hospitals and the character and quantity of medical supplies, an adequate knowledge of the climate is required. While it is probably true that modern medical science has rejected the older ideas of climatic diseases, it is certain that weather conditions have an important effect on many types of disease; and weather knowledge is essential if the hospital rate is to be kept low and if the hospital facilities are to be adequate for the requirements.

Statistical meteorology is of particular importance in determining sites for the location of airdromes. After aircraft are in the air they can usually take care of themselves, subject of course to certain dangers which, however, are practically all less serious than enemy fire. The greatest difficulty in connection with aircraft comes in the take-off and the landing. Wind speeds which can readily be negotiated by planes in the air will cause serious crashes if they occur while planes are leaving the ground or alighting. Statistical meteorology can give valuable information in connection with the occurrence of such winds. As the control of a considerable part of these winds is topographic, a difference of a few miles in location may make an airdrome, considered as a harbor, relatively safe rather than dangerous. The direction from which dangerous winds come may indicate the proper orientation of hangars and buildings in order that they may be relatively safe.

Another point to be considered in the selection of the location for an airdrome is the occurrence of fog. Fog over an airdrome usually entirely obscures it from above and makes landing difficult and dangerous. Statistical meteorology can be of particular benefit by determining the positions where such fogs are least frequent. As the dangerous fogs are most often of the radiation type, the selection of hills which extend upward through the usual fog is indicated for the location of airdromes. Such hills, of course, should not be high enough to have dangerous wind velocities and, at least as far as airdromes within range of enemy artillery are concerned, should

not be distinctive landmarks, as these offer excellent targets. The dangers of the occurrence of fog vary with the type of airdrome. For instance, morning fogs, the usual radiation type, are probably most dangerous to night-bombing squadrons, as night bombing is usually undertaken on clear or partly clear nights and the planes wish to return home as late as possible, that is at just the time when radiation fogs are most likely to occur. Airdromes for day bombardment groups do not need such careful location with reference to fog conditions, although it is desirable to avoid them as far as practicable. The possibilities of locating airdromes for observation, reconnaissance, artillery adjustment, pursuit, and combat groups are more limited, because these airdromes must be nearer the lines than those for bombardment groups. However, the meteorological officer should be able to give information that would lead to the selection of the best one from a number of possible locations. Furthermore, as the lines are advanced it is a great convenience if the airdromes of combat groups can be occupied successively by artillery adjustment, observation, and bombardment groups.

The distribution of *matériel* and personnel within any zone of military operations is controlled to some extent by the meteorological characteristics of the zone as shown in the records of the past weather. It is known to every one that the distribution of clothing, food, shelter, heat, and light is so controlled. The record of prevailing winds by months is probably the best available guide for the concentration on certain parts of the battle front of chemical warfare troops and *matériel*. The position of gas shell dumps needs especial attention in this connection. Light data, the time of moonrise and moonset, of sunrise and sunset, and the duration of twilight have been found of value by searchlight units, anti-aircraft artillery, and night-bombing air squadrons in the distribution of lookouts and other personnel and in preparations for activity.

In addition to the service that statistical meteorology can render to other arms of the expeditionary force, the service it can render to the meteorological organization itself should not be overlooked. In order to provide the necessary information, proper sources for obtaining these data must be assured. Different arrangements must be made in different regions; if the expeditionary force is to operate in a friendly country with an organized meteorological service which can be counted on to supply information for the back area, it will not be necessary for such a force to operate as large a service of its own as it must when operations are carried on in a hostile country or one poorly provided with meteorological stations. Furthermore, the number, frequency, and location of meteorological stations will be governed to a considerable extent by the climatic conditions of the region in which operations are to be carried on.

Current Information

Current information consists of various types of data for use by all operating units, including especially aircraft, artillery, chemical warfare, and

sound-ranging units. Information for aircraft consists of wind data for levels at which planes are likely to fly or in which captive or dirigible balloons may be used. Such data are becoming increasingly important as aerial navigation is developed, and allowance for drift of airplanes must be made. The meteorological officer with current information regarding winds at various levels in his possession can advise flying officers of the most satisfactory levels at which flights between designated places should be made. Another type of information of value to aircraft is the altitude of the clouds.

In the case of artillery the temperature, pressure, humidity, and movement of the air to the height reached by a projectile in flight are needed in correcting for the effects of these elements when laying the guns. Air density is a function of the first three elements; within limits air viscosity varies rather directly with temperature, but corrections for this variation are small, although appearing in the firing tables. It should be stated parenthetically that the firing tables contain corrections for powder temperature, but this should be determined by a thermometer exposed in a charge because powder temperature does not in general vary with air temperature. Possibly the most important meteorological conditions affecting the projectile are those which are known as "ballistic winds." Meteorological conditions begin to act on the projectile from the moment it leaves the gun and continue to act until it lands. The effect of variations from standard conditions in any layer of air is proportional to the time the projectile spends in that layer, provided it passes twice through it; that is, when the target is at approximately the same level as the gun. When the target is to be reached before the projectile arrives at the highest point of the trajectory, as is usually the case with anti-aircraft targets, the effect of any layer is proportional to the time the projectile spends in it and to the time of its travel from this layer to the target.

In the case of ordinary artillery the importance of the upper layers of air is evident when it is considered that a projectile spends half its time in the upper quarter of its trajectory. In practice the air through which a projectile passes is divided into layers which are considered separately, weighted with the proper factors, and then combined for the total height of the trajectory. From this combination a single artificial wind direction and a single artificial wind speed affecting the projectile are computed and given to the artillery as a ballistic wind. This ballistic wind represents the total effect of the wind on the projectile from the moment it leaves the gun until it lands or bursts. Speed is essential in the computation of ballistic winds in order that the artillery may have this information while it is still valid and before conditions have perceptibly changed. In practice it has been found that observations once in four hours are usually sufficient.

A development of the World War was the accurate determination of the location of enemy guns from the rate and direction of the travel of sound.

It has been found by experiment that this is affected more by the air movement at about one hundred meters above the earth's surface, than that at higher or lower levels; it is also affected by the temperature and humidity of the air; these observations must be furnished promptly to the sound-ranging units if such units are to operate with the maximum of efficiency.

Current information enables the medical officers to make more effective plans for their work. For instance, weather which tends to keep men in billets or barracks increases the hospital rate. During the occupation of Coblenz the influenza rate could be forecast from the temperature, cold weather causing the men to stay indoors with the resulting spread of infectious diseases. The current weather information will give medical officers time to prepare hospital facilities and enable them to foresee the demands which will be made on them; this will permit the accumulation of adequate medical personnel and supplies at the points of greatest need. For example, wet weather with temperatures at or below freezing will greatly increase the sick rate of men in trenches, and preparations for the treatment of frostbite, trench feet, etc., can be made so that cases may be treated as they come in.

Station Equipment and Reports

The equipment consists of the ordinary station instruments, together with pilot balloon equipment for observing the movement of the upper air, which must be known up to the highest levels reached by aircraft or by projectiles. Owing to the conditions under which military stations must operate, the strongest type of equipment is required in order to prevent excessive breakage. It is, of course, obvious that stations operating in the neighborhood of artillery or in places likely to be shelled or bombed cannot depend upon aneroid barometers, as these instruments are damaged by concussion. In the case of a direct hit the equipment will be destroyed; replacement equipment must therefore be available at not too great a distance.

Conditions at forward positions make it necessary to take pilot balloon observations with one theodolite, although two or even three theodolite observations doubtless make for greater accuracy. It is often difficult enough to find one theodolite position sheltered from enemy observation—where observation means destruction whenever the enemy is so minded—and there is practically no possibility of finding two such positions within sight of each other and of providing the necessary equipment for communication between them. In this connection it is desirable to note that all units operating under control of the expeditionary force should be interchangeable, that is it should be possible to replace a front line unit with the one from the rear; therefore differences in method for different locations are inadvisable. Furthermore, meteorologists with actual experience in the area of military operations are of the opinion that two single theodolite observations

from different locations are worth more than a double theodolite observation at one location, although the latter may be somewhat more accurate.

In connection with supplying ballistic winds to artillery and actual winds at various elevations for the air service it must be remembered that the artillery may fire through clouds and that it may be necessary for airplanes to fly through and above clouds. The unit making the meteorological observations has the most information upon which to estimate conditions when direct observations are impossible. Air movement in and above clouds may be determined by the methods of "sounding by sound," which in brief consist in sending a bomb aloft by a balloon and bursting it at a height approximately determined. The exact position in space at which the burst occurs can be determined by sound-ranging methods, and the exact height and the horizontal drift of the balloon from the time of release to the time of the explosion of the bomb can be computed. When such information is not available an alert meteorological observer can secure information which will enable him to estimate conditions with considerable accuracy. During cloudy weather he should watch for breaks in the clouds and attempt to get a balloon through these breaks even though the time for a regular observation has not arrived. Anti-aircraft guns may be fired through breaks in the clouds, and the drift of the smoke from the burst may be followed with a theodolite. The drift of clouds may be observed and the approximate height estimated. All reports from neighboring stations, friendly or enemy, should be recorded; as ballistic winds are usually sent to the artillery by radiotelegraphy, enemy information can be obtained if the meteorological observer takes pains to ascertain the times of sending and the wave length. His own equipment will enable him to receive the messages, and if the intelligence service of his army cannot provide him with the code used his ingenuity will enable him to work it out. From these miscellaneous data a successful estimate may be made. The firing tables issued to the artillery provide for meteorological data, and some value must be used for this term.

Weather Forecasting

Military forecasting should not be essentially different from any other sort of forecasting. Successful forecasting for the staff officers charged with the control of operations does, however, depend on an appreciation of their problems by the officer making the forecast. A forecast for military operations should be stated as concisely and definitely as possible; in fact, it is best to make direct positive statements of the future weather. Operations officers must take chances with many elements of which the weather is only one; what they require is the best estimate of the situation and some idea of the accuracy of the estimate. It is far better to state positively what the weather will be and to follow the definite forecast by a statement that the chance of its being correct is ten to one, five to one, or three to one, as the case may be.

Special forecasts may be made for all sorts of special operations. For example, the offensive use of gas requires detailed forecasts of local air movement in restricted localities; this often calls for special observations in detail at frequent intervals. The artillery frequently find it advisable to institute firing programs at particular times, such as dusk or dawn; the meteorological service will frequently be called upon to make special forecasts of visibility for these programs. Forecasts of the character of the night, whether clear, cloudy, or with broken cloud, are particularly important in planning offensive bombing operations by aircraft or in arranging for defense against possible enemy raids. For instance, if the conditions on the Lorraine front in the fall of 1918 indicated a moonlight night with broken cloud and a moderate west wind at reasonable flying levels, an enemy raid was practically certain and could be forecast with great accuracy; furthermore, with a little knowledge of the enemy's habits together with observations of his aerial activity during the preceding day, the point of the raid could generally be forecast.

In forecasting for an expeditionary force it is obvious that there is likely to be little opportunity for dependence on weather types and hence for empirical forecasting based on the resemblance of the current map to a type in the files. In his home country the forecaster is in touch with the maps of past years; all meteorological services have built up files of maps and in many cases have selected type maps which may be and usually are used, consciously or unconsciously, by the forecasters. In a region new to the forecaster this procedure is far from convenient and often impossible. Furthermore, the possibility of military activities in a region without published maps must be considered.

With the advance from empirical to rational methods in forecasting, this is not so great a difficulty as might appear. There can be little doubt that the future weather is the result of physical and dynamic processes which are going on currently, and current meteorological information and that of the immediate past should furnish all the data necessary for a proper forecast. It is a question whether forecasting has as yet reached a stage where this is possible, but experience with the American Expeditionary Forces in France and Germany leads to the belief that forecasting, at least for an expeditionary force, should be on this basis. Such a point of view, of course, lays more emphasis on theoretical physics than upon weather types and requires fundamental training in meteorological physics and the dynamics of fluids rather than experience in forecasting in the home country.

Distribution of Stations

The number and distribution of the stations operated by the meteorological service of an expeditionary force will depend upon many factors. In the back area the number will probably be about the same as would be required for peace-time meteorological information; if there is a suitable meteorologi-

cal organization already in this area its stations may well be used. It will probably be necessary to add a few stations at special points, such as artillery and other training fields and airdromes. The stations in the back area should serve for training meteorological personnel and supplying information to the military units stationed in this area as well as for making the fundamental observations upon which the forecasts are based. In the area of military activity there must be a greater density of stations. There should be at least one station in each region where airdromes are located, and stations to supply ballistic winds to the artillery and information to the sound-ranging and other services must be located along the front in sufficient numbers to give adequate information. The number will not be the same in different regions but will to some extent be governed by the general climatic conditions.

Furthermore, it has not yet been found practicable to operate a military meteorological service solely on the basis of the meteorological conditions encountered. Practical problems of tactical organization make it desirable that the meteorological units bear a rather definite relation to the tactical divisions by which the army operates. Perhaps the most usual and satisfactory organization is that of a first-class station completely equipped for all observations and for weather-forecasting attached to each field army. This station should be in close touch with the army headquarters and should have telegraphic communication with the stations in the back area to provide it with the information necessary for forecasting. In addition to the forecasting station in the army area, it will be found desirable to establish from two to five or more stations in the same area to serve the artillery and other units. Inasmuch as tactical considerations play a very important part in the organization of the army area, the most convenient arrangement appears to be the assignment of one of these substations to each army corps. The conditions existing in the particular region will undoubtedly serve to modify the general plan; but if equipment and personnel are provided for a first-class forecasting station attached to army headquarters and an observation station equipped for surface and upper air observations for each army corps, it will be possible in nearly all cases to provide the forward area with an adequate meteorological service. The back area is a regional problem and from a tactical point of view must be handled in much the same manner as the lines of communications of the armies.

MONSOON AND TRADE WINDS AS RAIN MAKERS AND DESERT MAKERS

By Alexander McAdie
Harvard University

Much has been written about monsoons, but it must be confessed that it is difficult to follow the explanation of these winds given in most textbooks. One reads, therefore, with great relief the simple, straightforward exposition of the southwest monsoon of India[1] given by the new Director of the British Meteorological Office, Dr. G. C. Simpson, long connected with the Indian Meteorological Service and well known for his work with Scott in the Antarctic.

The word "monsoon," most of us know, is from the Arabic and means season. Meteorologists now quite generally make an adjective of the word, to indicate a seasonal wind. More precisely it is a flow of air, directly associated with the northward or southward swinging of the great air streams—the trades and the prevailing westerlies. "Monsoon," however, has always been associated with rain, indeed copious rain. It is said that the military expeditions of Alexander brought back to Greece a knowledge of these rain winds and, presumably, the dependence of the harvest upon their early arrival. And so in India the word has come to mean the rainy season, from June to September.

Usual Explanation of the Monsoon Insufficient

Now the usual explanation of the cause of the monsoon is that during summer the air over the interior of Asia (or other continents) is so much warmer than the air over the water (in this case the Indian Ocean, Arabian Sea, and Bay of Bengal) that an inflow occurs. This is also the explanation generally given for sea breeze. In neither case is the explanation sufficient. Dr. Simpson points out that India is much hotter in May, before the monsoon begins, than in July, when the monsoon is in full swing; and, what is the more suggestive, the hottest part of India, the northwest, gets no monsoonal wind or rain; and, finally, the temperature is higher in years of deficient rains than during good monsoons.

Monsoonal Influences on the Californian Coast

Furthermore, it must not be forgotten that often when there are moisture-laden winds blowing into a warmer region, rain does not fall. There must

[1] "The South-west Monsoon," *Quart. Journ. Royal Meteorol. Soc.*, No. 199, Vol. 47, 1921, pp. 151–172.

be rapid and sufficient cooling. This cooling may be brought about by various means; but chiefly it is accomplished by uplift and expansion. A good example of failure to produce rain occurs on our own Californian coast in midsummer. The prevailing west winds are essentially monsoonal in character and carry at least 10 grams of water vapor to every cubic meter of air. These winds blow steadily from late forenoon until after sunset, with an average surface speed of 10 meters per second. No rain falls; yet if only one-tenth of the vapor were condensed and one-tenth of this pre-

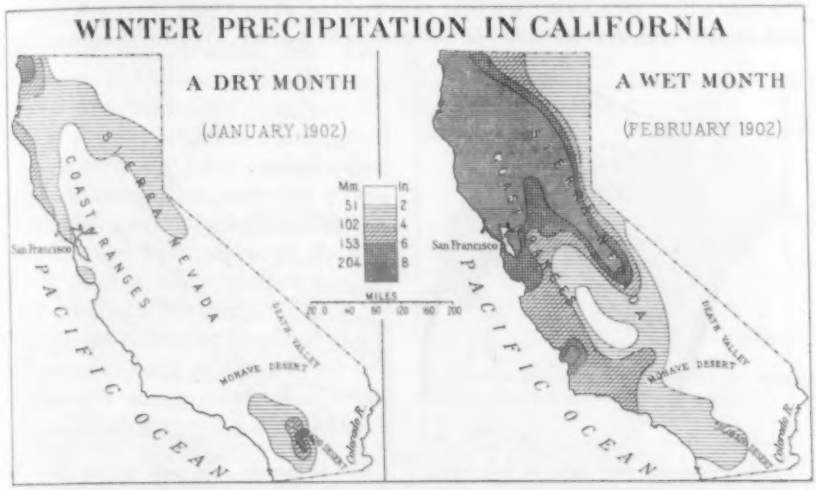

FIG. 1—Maps showing the distribution of total precipitation in California during dry (January, 1902) and wet (February, 1902) winter months. In the case of the former the precipitation amounted to approximately 24,000,000 tons of water; in the latter 150,000,000 tons.

cipitated, the rainfall would exceed five millimeters, or two tons to the acre per day.

The heavy fogs along the Californian coast show that the water vapor is present and can be condensed on a surface of lower temperature. There is, however, no rain, although the air stream must rise at least 2,000 meters in the comparatively short distance of 150 kilometers. The reason is that the air stream is flowing into a region of much higher temperature, and the mountains are rendered non-effective rain makers. But for this heating there would be heavy rainfall in summer just east of the crests of the Sierra and the Coast Range; and what is now largely desert would be a region bountifully supplied with water.

In a dry midsummer month very little rain falls in California. The storm paths have swung far northward, and the mountains are not able to rob the prevailing westerlies of even a small part of their load of water vapor. In such a month the total rainfall of California may not exceed 156,000 tons of water, or about one ton to the acre.

In a dry midwinter month, however, an occasional storm assisting, the mountains rob the air streams of much of the moisture; and even in an exceptionally dry winter the monthly rainfall will amount to 20,000,000 tons of water. During a wet winter month, chiefly because of the succession of storms from the north, the rainfall for the state may equal or even exceed 150,000,000 tons of water.[3]

Complexity of Causes of the Monsoon in India

From what precedes we see that rain making, even where there is a strong and steady seasonal air flow, is not a simple matter. We fully agree with

Fig. 2—Rainfall over India in July (after Simpson). Rainfall is in inches.

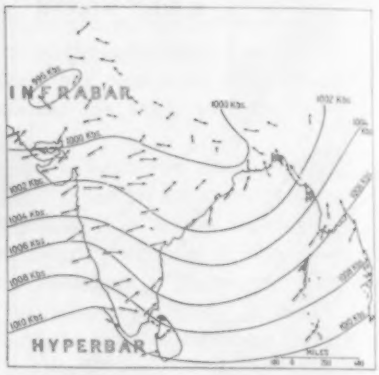

Fig. 3—Pressure over India in July (after Simpson). Pressure is in kilobars (1000 kbs. = megadyne atmosphere).

Dr. Simpson when he says that rain as dependent upon the monsoon or indeed the monsoon itself is

> not the simple result of a single physical condition. It is produced by a combination of circumstances, involving consideration of temperature, pressure, humidity, geographical relationships between land and sea, the rotation of the earth, and lastly, but probably the most important, the distribution of mountain ranges.

There is no question but that the southwest monsoon of early summer is a rain-bearing wind *par excellence* for India. Dr. Simpson, in a series of maps showing pressure centers, air flow, temperature, and rainfall for the months of May and July, makes plain the sweep of the rain-bearing winds and the action of the mountains.

The air strikes the western coast of India almost at right angles; over the Bay of Bengal, traveling in a large circle, it impinges on the coast of southern Burma almost at right angles; to swing again, nearly parallel to the coast of northern Burma and then across deltaic Bengal, in a steady

[3] See the author's "Climatology of California," *U. S. Weather Bur. Bull. L*, 1903, and his "The Rainfall of California," *Univ. of California Publs. in Geography*, Vol. 1, 1914, No. 4.

current from the south. Air which crosses the coast of Bengal is deflected to the north soon after crossing and becomes a southeasterly or easterly wind along the foot of the Himalayas into the Punjab.

From a study of Figure 4 it is plain that the mountains stand as a box, or receiver, with two sides into which the air pours and that it must flow over the edges at an elevation of at least 2,000 meters—the minimum height of the mountain wall in the east (in reality the ascent is more nearly 6,000 meters). It is to this forced draft that India owes its rainfall: "the ascensional currents due to India being warm are absolutely insignificant in comparison."

The main currents from the south of the Arabian Sea (air streams I, II, and III in Fig. 4) strike the Western Ghats practically at right angles and are forced to rise vertically 1,500 meters. Now the air stream has traveled 7,000 kilometers over the ocean and has an average saturation of 90 per cent, with a mean temperature of 1,094 Kelvin kilograds (78° F.).[3] There are nearly 25 grams of water vapor with each cubic meter of air. One need not wonder, then, that the rainfall is very heavy in certain places. On the Western Ghats the amount is 1,270 millimeters (50 inches) in a month, or 182 tons to the acre per day—three times as much as we get on the northern coast of California in a winter storm.

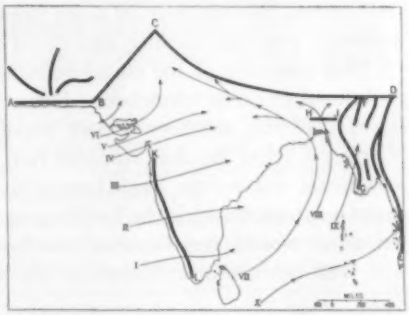

FIG. 4—Air stream lines during monsoon, showing relation to mountain systems (after Simpson).

The rainfall of Cherrapunji is generally said to be the heaviest in the world,[4] and we quote Dr. Simpson:

> The most interesting case is that of stream line VIII. The air in this current leaves the Bay practically saturated; it then crosses deltaic Bengal, which at this time of year is practically one great swamp—in fact a continuation of the sea, except that its water is fresh. This air current strikes the Khasi Hills, in Assam, at right angles. These hills near Cherrapunji present almost a vertical face to the air current, which has to rise almost vertically for 4,000 feet. Such a rapid rise through 4,000 feet of a warm saturated air current blowing with a velocity of many miles an hour causes heavy deposition of water which falls on the top of the hills with great intensity. The annual rainfall of Cherrapunji is 424 inches, the greatest recorded rainfall on the face of the earth, although there may be places in the Western Ghats where the rainfall is locally heavier. Practically the whole of this great amount falls during the monsoon.

[3] In this scale of temperature zero is the absolute zero (−273.12° C., or −459.4° F.) and 1,000 is the freezing point of water under megabar pressure.

[4] However, this may not be the heaviest rainfall on the face of the earth. G. K. Larrison states that Mt. Waialeale, on the island of Kauai, Hawaiian Islands, with an elevation of 1,548 meters (5,080 feet), has an average annual rainfall (based on records for five years) of 12.09 meters (476 inches). From a study of records of near-by stations he thinks that in 1918 and 1914, in which years unfortunately the records were lost, the rainfall must have approximated 15.24 meters (600 inches) (*Monthly Weather Rev.*, Vol. 47, 1919, pp. 303–305). At Cherrapunji the maximum precipitation is supposed to have occurred in 1861, when 22.99 meters (905 inches) were recorded, but the record may be erroneous.

Winds that Cause Deserts

But, if the winds can bring rain, paradoxical as it may seem they can also prevent rain from falling and in extreme cases can cause deserts. We now know from aerographical studies that, although warm moist air may be rising and cumulus clouds may be forming, a strong upper-air current may blow the clouds away and interrupt the process of rain making. Indeed, the most significant feature of Dr. Simpson's study of the monsoon is the conclusion that the dry region to the northwest of India is due not only to the barrier of the mountains and the deflection of the moist air currents but also to the existence of a dry upper wind, which, with warm air over the interior, prevents cooling and cloud building.

This arresting of the cloud-building, rain-making process by wind action is known to occur elsewhere. For instance, I. R. Tannehill, discussing the rainfall of the southern Texan coast,[5] shows quite clearly that the reason Corpus Christi has less summer rain than Galveston is because the strong southeast wind—the fresh breeze from the Gulf, essentially a monsoonal wind—interferes with the building up of summer cumuli and cumulo-nimbi. In other words, convectional processes go on along the northern coast of the Gulf but are interrupted on the southern coast.

The Monsoonal Rain of India

To return to the problem of the efficiency of the southwest monsoon as a rain maker. Under the influence of the pressure distribution and the earth's rotation the air in the south of the Indian Ocean moves towards the equator in a northwesterly direction. Beyond the equator it passes into the circulation moving in a northeasterly direction, thus bringing moist air from the southern into the northern air system. The high vapor content of the monsoon comes with the great distance the air stream has traveled over warm water. It is only when the air passes from the southeast trade into the circulation controlled by the Asian infrabar that *enough* damp air reaches India to cause cloud and rain in sufficient amount to overcome any increase in temperature over the land and thus establish the monsoonal rain. Simpson shows plainly that the monsoon must be traced back beyond the Arabian Sea—much farther indeed—back to where the air stream recurves far south of the equator and becomes linked up with the southeast trade. The circulation controlling the monsoon may thus be likened to a gigantic letter S, the equator passing through the middle.

When the air flowing over the Arabian Sea is deflected to the right, and becomes a northwest wind instead of a southwest, then the season is a dry one in India; and it matters not whether the mountains are high or at what angle the ranges face the on-coming winds. Such a deflection may be caused in part by the earth's rotative deflecting force, but chiefly it is

[5] *Monthly Weather Rev.*, September, 1921, p. 498.

caused by a displacement of the Asian infrabar to the southeast. If at the same time the Indian Ocean summer hyperbar is shifted south, then there is less southerly wind, and the lower half of the gigantic S circulation practically disappears.

Seasonal Rain on the Pacific Coast

The case is somewhat different on our Pacific coast. In an exhaustive paper on "Seasonal Forecasting of Precipitation—Pacific Coast" Professor A. J. Henry discusses three classes of seasonal rainfall and their probable causes.[6] The tables given are detailed, but the conclusions are best expressed in the addendum where he quotes two general laws deduced by the author of this article, with which he states his own findings are "in close accord."[7] These laws as quoted read

A. When the continental HIGH [hyperbar] overlies Oregon, Idaho, Utah, and Nevada, the general drift of the surface air is from the north or northeast, and such a circulation favors fair weather, with little precipitation. . . . Individual LOWS are restricted to northern counties and pass eastward without extending southward.

B. When the north Pacific low area (the Aleutian LOW [infrabar]) extends well southward along the Oregon coast and the continental HIGH overlies Assiniboia [now Saskatchewan] and Montana, the general drift of the surface air in California is from the south or southeast. Conditions (then) favor unsettled weather, with frequent heavy rains west of the Sierra and heavy snow fall in the Sierra. Individual HIGHS appear with little warning north and east of the Kootenai and move, as a rule, slowly south. Individual LOWS appearing over Vancouver Island and the north coast of Washington deepen and also extend southward, the rain area reaching Northern California in 12 hours, the central coast in 24 hours, and the coast south of Point Conception in 36 hours.

Variation in Seasonal Rainfall and Its Prediction

The laws A and B were set forth in 1908 and, in the light of Dr. Simpson's work, can now be amplified by the addition of a third law:

C. A dry period in winter on the coast of California is caused by a deflection of the wind from southwest or south to west or northwest, due primarily to a retrogression of the Aleutian infrabar. Such winds blow parallel to the coast, have traversed but a short distance, and are moving from colder to warmer regions. The mountains of California cannot act as efficient condensers.

Conversely, heavy and frequent rains are due to long-distance air streams impinging as southwest winds on the coast. These streams may have had their origin as northeast trades which, recurving and working north, describe a semi-circular path of 6,000 kilometers and merge into the flow around the Aleutian infrabar, which extends far south. With an initial temperature of 1,090 kilograds (77° F.) and a final temperature of 1,040 (52° F.) the saturation weights have changed from 22 grams per cubic meter, or two pounds of water vapor with every thousand cubic yards of air, to a saturation

[6] *Monthly Weather Rev.*, April, 1921, pp. 213–219.
[7] *Monthly Weather Rev.*, Vol. 36, 1908, p. 100.

weight of 10 grams, or one pound of water vapor. It is plain that the Coast Range, the Sierra, and the Cascades can *now* act energetically as rain makers, for a moderate uplift of the air streams gives sufficient cooling to produce generous rain.

A wet winter means much to California, for the water supply is all important; and provision must be made for the long rainless summer. Right in the heart of a rainy season there may come a dry period. This condition, which for a long time baffled explanation, is now seen to be due to an interruption of the circuit of the air stream over the ocean. This happens when air surges southward from the Yukon. Usually the flow is southeast and on the inner side of the Siskiyou and the Coast Ranges; but occasionally the polar front bulges southwest, and the ocean winds are forced seaward. At such times heavy snow falls on the immediate coasts of Washington and Oregon; but California for the most part is dry.

What the cause of these polar surges may be awaits explanation; but forecasters are everywhere awake to the significance of these south-directed tongues of Arctic air. Likewise the importance of a knowledge of the strength and shift of hyperbars and infrabars is appreciated, especially in forecasting seasonal rainfalls. The unprecedented drought in England during 1921 might have been successfully forecast.

The flow of air from the Atlantic was below the normal and instead of the usual frequent showers, there were long rainless months, with wind from the south. Anticyclonic conditions prevailed. C. E. P. Brooks, through whose persistent labors the network of world surface air data (*Réseau Mondial*) was made possible, shows[8] that during the period from February to June, 1921, a hyperbar with an excess of pressure equal to six kilobars (the whole atmosphere is 1,000 kilobars) was centered over England and northwestern France. An infrabar was centered near Spitsbergen and was fully six kilobars below normal. Hence there was a strong flow of dry air northward, into a region where, furthermore, temperature was considerably above normal.

How far-reaching the effects of these great displacements are is shown by the fact that the temperature over the central part of the United States during this period was from 10 to 16 kilograds above normal. Thus at Chicago the excess temperature was 16 kilograds (eight Fahrenheit degrees) and might naturally have given rise to the belief that the climate was changing. There was a change, but not a permanent one. The year 1921, in brief, was like 1911 when similar but less pronounced high temperature and low rainfall prevailed over Europe.

Occurrence of Drought and Formation of Deserts

Finally, we seem to be about to discover a law connected with the occurrence of droughts and the formation of deserts.

[8] C. E. P. Brooks: Could the Drought of 1921 Have Been Forecasted? *Meteorol. Mag.*, September, 1921, pp. 211–215.

Two infrabars, the Icelandic and the Aleutian, extensions probably of a large subpolar sink, from time to time are displaced far south; and the hyperbars of the temperate latitudes swing south in company. Such movements make for strong southwest winds on our Pacific and the European Atlantic coasts, and rain falls easily. But, when the Icelandic and Aleutian infrabars lie far north of their normal localities, then we have high temperature, variable winds, and scanty rain. And these larger pressure areas apparently control the path, frequency, and intensity of the smaller pressure areas known as cyclonic storms. Also, and this is most important, they determine the length and strength of the great seasonal air streams, the trade winds and the monsoons, and thus control rainfall.

CLEANSING NEW YORK HARBOR

By Sidney A. Reeve

For many years the pollution of the water of New York harbor has been very bad. The ejection of the city's sewage into the North and East Rivers, combined with some carelessness as to dead animals and some infraction of the law by the manufacturing industries, has led to a situation which is nothing short of a disgrace for the first city of America.

Within the last few years conditions have been made considerably worse by the transformation of many large ships from coal to oil burners. Heavy scums of waste oil have coated the water and even the river shores as far north of the city as the flood tide sets in and all of the beaches below the city inside of Norton's Point and Sandy Hook. The presence of this oil upon the water has led to at least one serious fire.

Meanwhile New York has advanced in rank from the first city in America to the first city in the world in financial importance if not in population. It is the port of entry for world travel towards the greatest of all world centers. That its harbor should be as dirty as it now is, has become a national disgrace.

The cleansing of the harbor has for some time been a matter of concern to several of our prominent citizens. The only outcome of their efforts, however, has been an attempt at better enforcement of existing laws. Since even a perfect enforcement of the laws would still leave the harbor polluted with sewage, which is really the worst of the features mentioned if not the one most offensive to the eye, it is worth while to consider whether measures might not be taken which would rid us of all sorts of pollution at once. For this could be accomplished by rinsing out the harbor twice a day with clean sea water, by tidal action controlled by suitable tidal gates.

Natural Cleansing Effect of the Tides

In order that this possibility may be clear to the reader, reference should be made to the outline map of New York harbor and neighboring waters, Figure 1. The map shows the waters immediately surrounding Manhattan Island to be accessible to tidal action from the sea in two directions, namely: (1) from the south, through the Narrows, and (2) from the east, through Long Island Sound and Hell Gate. The tides entering by these two routes do so fairly simultaneously, giving rise to the tidal phenomena in the East River, as a result of which somewhat more water flows in a southwestwardly direction through Hell Gate, on the ebb, than passes in in the northeasterly direction on the flood. The slight difference in the time and force of the two tides results in the draining, on the ebb, of a small portion of the clean

sea water which had been sent in through Long Island Sound on the flood, out through the East, Harlem, and Hudson Rivers and thus out to sea through the Narrows.

At present this slight rinsing action is the only factor tending to cleanse New York Harbor of its pollution at all; for the amount of fresh water

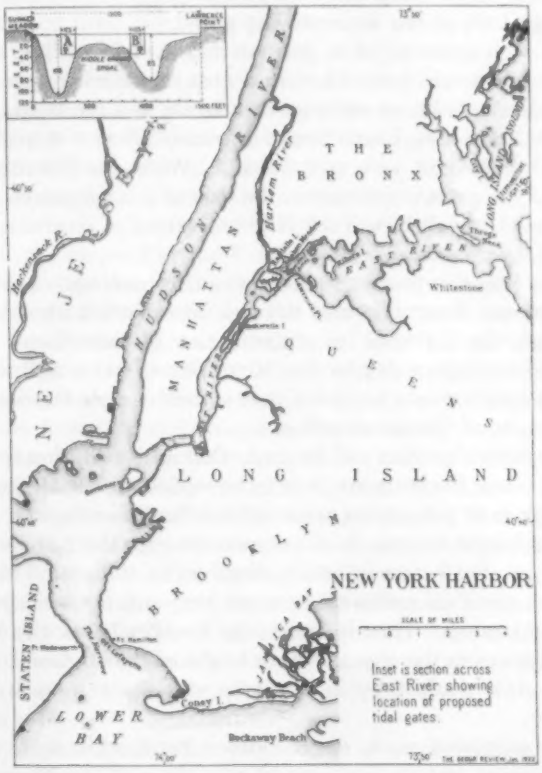

FIG. 1—Outline map of New York harbor and neighboring waters to illustrate the proposal to erect tidal gates across East River as shown in the inset section. The vertical scale of the section is five times the horizontal scale.

coming down through the Hudson is insignificant in comparison with the size of the estuary and is quite inadequate for the dilution of the city's sewage to an appreciable degree. Yet if this slight degree of cleansing did not occur, the waters of the harbor would long ago have become so foul as to be intolerable.

INCREASING THE CLEANSING ACTION BY TIDAL GATES

The object of the present paper is to point out the fact that the natural cleansing action of the tides might be multiplied manyfold by the erection

of tidal gates in East River at some point near Wards Island. Such gates are supposed to be operated by power, automatically set into action by the turn of the tidal current, in such manner that on the eastward flow of the tide through Hell Gate they are closed, while during the westward flow they stand open. The gates would involve a problem that is not serious either from the engineering or the financial point of view, in comparison with the magnitude of the interests concerned.

Supposing such gates to be in position and operation, their closure during the flood tide would force all of that area of waterway between Wards Island and Throgs Neck, or perhaps even as far as City Island, to fill with fresh sea water from Long Island Sound instead of filling with polluted harbor water through Hell Gate, as is now the case. When the tide turned for ebb, the opening of the gates would permit the bulk of this surplus clean sea water to escape to sea through New York Harbor, instead of returning eastwardly into Long Island Sound, as it does now.

Twice every day this process would put, on the average, about ten billion gallons of pure sea water into and through New York harbor, washing out to sea through the Narrows its accumulation of impurities. The actual amount would vary from day to day, according to moon and weather; but the average amount would be about that stated—ample for rinsing out the harbor to a state of virtual cleanliness.

Since immediate objection will be made that such pollution is not wanted in the waters below the Narrows, it is to be replied that *it all goes there now, anyhow*. There is at present no appreciable efflux of sewage or other pollution into Long Island Sound. It all goes out through the Narrows, polluting the adjacent beaches before it finally dissolves in the sea. The trouble at present is that the local pollution becomes very much concentrated before it is washed out to sea. That is to say, the beaches below the Narrows, as well as the wharves in the city and both banks of the Hudson to and above Yonkers, are now washed by a relatively stationary quantity of highly polluted water.

Under the suggested plan, on the other hand, this same amount of pollution—no more and no less—would pass through the Narrows; but in the proposed situation it would be diluted, say tenfold more than it is at present. For this reason the bulk of it would flow past the adjacent shores into deep water without finding opportunity for the deposit of sediment upon the beaches; whereas now the polluted water drifts sluggishly back and forth until the wind has had time to deposit most of its burden upon the shore.

Relation to Navigation

Since a second obvious objection to the procedure suggested lies in its interference with navigation, the inset figure is added, showing in profile the cross-sectional area of East River at a possible point for the tidal gates, namely, opposite Sunken Meadow, across Middle Ground Shoal. At this

point the channel is split in two by the Shoal, leaving a waterway 83 feet deep at mean low water to the east of the Shoal and one 108 feet deep to the west of the Shoal. This is the deepest spot in the Harbor north of the Narrows.

The inset shows how this depth conduces to the operation of the supposed tidal gates, even if gateways for navigation have to be left open during the daylight flood tide. Such ship gateways are shown at *A* for the western channel and at *B* for the eastern channel, each gateway being 125 feet wide by 36 feet deep. The profile shows that even if waterways of this size had to be left open, there would still remain a closure of the greater portion of the area available for tidal flow. This is all that is necessary. Furthermore, when the flood tide occurred during the later hours of the night this leakage due to navigation could be avoided by closing the entire area of waterway.

So great is the demand of the Flushing Bay district for sea water during the flood tide, that the latter sets in from the southward not only past Blackwells Island, but also through the circuitous path around Manhattan Island—up the Hudson River, through the Ship Canal, and then southwardly through the Harlem River. Even with this additional water supply the rate of tidal flow past Wards Island is from 2 to 3½ knots. This strong current shows how powerful would be the cleansing action, provided this flow were shut off during one tide, so as to set back in the form of clean sea water during the ebb. Then the effluent clean sea water would flow not only down East River, but also up the Harlem and into the Hudson at Spuyten Duyvil, purifying that beautiful estuary well above Yonkers.

In order to shut off this flow through the Harlem River also, on the flood tide, smaller tidal gates would have to be installed between the Sunken Meadows and Randalls Island, and also between Randalls Island and the mainland. These two channels, however, are not only small and shallow but are of no importance to navigation and hence could always be closed on the flood tide.

No estimate has been made of the cost of such tidal works, but it is obvious that it would be slight in comparison with the object sought.

THE INFLUENCE OF GEOGRAPHIC FACTORS ON OCEAN SHIPPING*

By E. S. Gregg
U. S. Department of Commerce

In 1914 there were only four American vessels regularly crossing the Atlantic, and altogether only 735,000 tons of steamers registered for foreign trade; today there are 10.5 million tons so documented. In fact we have so many ships we do not know what to do with them. The American merchant marine, grown large and awkward in these few years, presents a problem that needs the aid not only of economists and business men but also of geographers. It is admitted that many economic handicaps will have to be overcome or neutralized by legislative or other action and that political considerations will complicate and delay a decisive settlement of our shipping problem. But geographers can render valuable service in calling attention to one important factor which has been too frequently neglected—the influence of the distribution of natural resources on industrial and maritime development. On the basis of the work of commercial geographers with reference to this factor, and with new information lately made available, it is now possible to determine, with an approach to scientific accuracy, the services essential to our trade and to formulate from the viewpoint of national economy a statement of the influence of geographic factors on the ocean shipping of a country.

One-sided Character of American Shipping

Heretofore trade statistics have been collected mainly from the commercial viewpoint, in terms of value, and have been poorly adapted to the needs of shipping. Owing to the pioneer work of a member of the Association of American Geographers we are now getting excellent trade returns from the shipping viewpoint in terms of long tons. Under the authority of Section 21 of the Shipping Act of 1916 the master of each vessel, upon entering and clearing a port, is required by the Shipping Board to make a statement showing the total tons of cargo by principal articles on board his ship, the port of origin or destination, and other details. These reports are made by ships of 500 gross tons and over entering from, or clearing for, a foreign port. While the results compiled are not yet absolutely inclusive, the percentage of error is small; and the figures can be taken as characteristic of our commerce.

* Read at the Washington Meeting of the Association of American Geographers, December, 1921.

The most striking point brought out by these statistics is the one-sided nature of our trade—a fact not surprising in view of the character and extent of our natural resources yet consistently overlooked by those who are volubly insisting on the desirability of a large American merchant marine. An equally important deduction follows: Shipping cannot well exist on one-way traffic. Without a bulky import trade, the United States is at a disadvantage in the ownership and operation of a large merchant fleet and certainly would find difficulty in operating one which some insist should be large enough to carry 50 per cent of the total volume of our trade.

In the year ended June 30, 1921, imports into the United States amounted to 36 million long tons, as compared with exports of 58 million; or, if bulk oil, which moves in specialized tankers, is excluded, the comparison is 18 million tons to 52 million.[1] In shipping terms this disproportion means roughly that two-thirds of the cargo ships which go out loaded must return empty. Expressed in terms of ocean freight rates, this is the equivalent of saying that outbound rates must be high enough to pay for the return of the ships in ballast. Complaints are constantly made because rates from this country are much higher than those to this country. When three ships are bidding for cargo enough for only one, and when vessel owners are faced with the necessity of buying ballast if no cargo for this country can be obtained, it is entirely logical to expect low rates on inbound traffic. Low inward rates are an aid to foreigners in landing their goods at our docks and make more difficult the placing of our goods abroad in competition with other countries.

Analysis of the Trade of Certain American Ports

As might be expected, this overbalanced relationship between exports and imports is accentuated in certain regions and reversed in others. An analysis of the trade of some of our important ports will serve to illustrate this condition. Boston's trade is in contrast with that of the other major ports, since its imports are three times the volume of its exports: 2,349,363 tons as against 712,000 tons. New England imports heavy materials such as oil, sugar, wool, hides, and the like; it exports light miscellaneous manufactured products. Boston's imports come from raw-material-producing countries; in 1921 from Mexico, 1,012,547 tons; from India, 269,490 tons; from Cuba, 237,706 tons; from China, 113,413 tons; or 70 per cent of its total imports. To these countries Boston exported only 39,879 tons. On the other hand, Boston's exports go largely to industrial countries: to the United Kingdom, 398,800 tons; to Holland and Belgium, 70,130 tons; and to Germany, 60,684 tons; or 73 per cent of its total exports. Imports from these countries into Boston in 1921 amounted to 219,221 tons and made a more nearly balanced trade of manufactured goods moving both ways.

[1] *Commerce Repts.*, Sept. 26, 1921, p. 243; *ibid.*, Nov. 21, 1921, pp. 713–714. Figures for the ports are taken from these articles and from the more detailed material in the Bureau of Foreign and Domestic Commerce on which they are based.

Middle West wheat and steel products, necessary for what might be called ballast for the light products of the region, are not now moving through Boston. It is not unusual for a ship to discharge at Boston and then proceed to New York to take on a load of products originating around Boston. New England, with its scanty natural resources and its advanced industrial development, is having difficulty in supporting direct shipping.

The Hampton Roads ports are an example of the contrary situation. Norfolk and Newport News together exported 12,026,257 tons in the fiscal year 1921 and imported less than 300,000 tons. Exports from these ports were greatest to South America—2,676,816 tons; and strangely enough, next in order was the United Kingdom, which took 1,337,622 tons; France followed with 1,301,016 tons; then Germany, Holland, and Belgium with 906,350 tons together, Italy with 895,670 tons, and Cuba with 471,177—a total of 7,588,651 tons out of 12,026,257. These regions sent only 188,341 tons into Hampton Roads. The ships of all countries are called upon for this export movement, which is mainly coal, and the choice is uniformly on the basis of the lowest rate. The fact that this trade is unbalanced does not keep shipping from the Roads, since many countries must have our fuel; but, because of other economic handicaps, the large outbound movement of coal is not of the advantage to our shipping that the British exportation of coal is to British shipping, as will be shown later.

Few cases illustrate better the influence of the geographic distribution of natural resources on shipping. The distance from Cardiff to Buenos Aires is greater than that from Hampton Roads; yet a British vessel can carry coal to the Argentine as cheaply and certainly more profitably than an American vessel can carry it from Norfolk. The British vessel brings back a load of wheat, which pays part of the expense; the American ship generally comes back empty. Nature and the trend of economic development have given the United Kingdom a fairly well-balanced trade as the result of its coal deposits. From the shipping standpoint the United States labors under the handicap of abundant natural resources, however paradoxical this may seem.

The disparity between outbound and inbound traffic is not so great in the case of San Francisco. Exports in 1921 totaled 1,291,505 tons, against imports of 882,826 tons. Steel, oil, grain, and lumber go out, while jute, coconut meat and copra, nitrate of soda, rice, and vegetable oils—all fairly heavy—come in. The trade of San Francisco with Australia and New Zealand almost balanced, imports into San Francisco amounting to 82,149 tons and exports amounting to 80,788 tons; likewise its trade with India almost balanced—45,328 tons inbound, 42,974 outbound. On the other hand, 100,022 tons were brought in from the east coast of Mexico, to which nothing was sent; while imports from the west coast of Mexico totaled 6,463 tons as against exports to that section of 19,879 tons.

The outbound trade of New York amounted to 11,341,351 tons, as compared with 9,205,809 tons inbound. Imports from Mexico were 3,525,374

tons, or over one-third of the total; and most of this trade consisted of crude oil carried in specialized vessels. This means that general cargo vessels carrying freight from New York found, on an average, scarcely more than half a shipload of cargo for the return voyage. A detailed discussion of the trade of New York would serve to show the extent of this disparity on the various routes; but such an analysis will not be attempted here. Data on this point will subsequently be published.

The Kind of Shipping We Need

In considering the steamship services necessary for our trade, it is of primary importance to recognize that the imports of oil and the exports of bulky raw materials must be considered separately. As already pointed out, crude oil moves in specialized vessels which are an integral part of a very profitable business. The exports of heavy raw materials go largely in tramp ships, a type of service this country can not logically be expected to develop. These raw materials normally move to the seaboard before being sold ultimately, so that it is difficult for the seller to divert his shipment to an American vessel. In other words, our real problem is that of determining and establishing liner services to carry a reasonable share of our trade in manufactured and semi-manufactured goods with enough heavy raw materials to make each cargo stow to advantage.

If crude oil is excluded from imports, and coal, bulk oil, grain, cotton, and lumber from exports, the result is an inward and outward volume of cargo fairly well balanced. In the year ended June 30, 1921, out of a total exportation of 58 million tons, exports of coal, bulk oil, grain, cotton, and lumber accounted for approximately 35 million tons,[2] leaving about 23 million tons of miscellaneous commodities; as against imports, exclusive of oil, of about 18 million tons.

The uncritical statement is made that the United States needs a merchant marine of 10 million gross tons to carry 50 per cent of its products. I suspect that a careful analysis would lead to the conclusion that all the cargo and passenger shipping we can support from the profits of operation plus any subsidies which are likely to be granted, is the quantity of tonnage necessary to transport 50 per cent of our imports, excluding oil, and 50 per cent of our exports, excluding coal, grain, cotton, and the like. One hesitates to make this statement because it is preliminary in character and because it is likely to be misunderstood by partisans of certain grandiose schemes. But the discussion must be brought down from the air and grounded in the facts of the case. It is hoped that shortly a defensible estimate of the quantity and character of tonnage necessary to move 50 per cent of our manufactured and semi-manufactured goods can be put forward for critical analysis and revision.

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[2] *Monthly Summary of Foreign Commerce of the United States*, June, 1921, Part I.

Disadvantage of a Country Rich in Natural Resources

On the basis of what has been outlined it may be said that a country which has been endowed liberally by nature with raw materials necessary to an advanced industrial development cannot maintain, except at an unusual expense, a merchant marine large enough to carry 50 per cent of its total trade. The exploitation of its natural resources is more profitable than shipping ventures. It loses interest in its materials as soon as they are sold and rarely cares in what vessels they are shipped. The exportation of primary commodities will unbalance its trade, and the profitableness of trafficking in these articles, so eagerly sought after by other less fortunate countries, makes unnecessary, and therefore unlikely, the development of that peculiar genius of management and economy needful for the successful operation of ships on multilateral voyages. In other words, there is not sufficient economic pressure to produce tramp ship operators, and tramps are the type of ships needed for bulky materials. The United States is a case in point, though other raw-material countries illustrate the point equally well. Spain's imports in 1920 were 3.7 million tons, as compared with exports of 8.7 million.[3] A large part of the outward movement was ore, and Spain can be considered as a raw-material-country with an insignificant merchant marine in proportion to its trade.

Countries poor in natural resources, but with large and vigorous populations, are forced into lines of activity which do not pay so well perhaps as exploiting the gifts of nature. These alternative activities are usually international trade and services, and of these the shipping industry is inevitably one of the most important. Looked at in perspective, international trade has been the exploitation of the raw materials of countries with little industrial development by those countries which have progressed further along that line. On the other hand, the tendency now seems to be for each of the countries more backward industrially to force, by protection or other means, the growth of manufactures. One refrains from trying to conceive what will happen when all countries are developed to the *n*th degree industrially, or to calculate where and what the profit in trade will be.

Ocean-Trade Advantage of the United Kingdom

It is necessary for countries poor in natural resources to bring in bulky raw materials. These pay something toward the expenses of a ship's operation and consequently enable lower outward rates to be made on finished products. The United Kingdom, quite apart from its geographic location, is an example. The large outward movement of coal makes it possible for British ships to bring in the essential foodstuffs and raw materials cheaply, and the importation of large quantities of bulky products enables favorable rates to be made on the export of British manufactured goods. Exports

[3] *Commerce Repts.*, Dec. 5, 1921, p. 849.

from the United Kingdom in 1913 amounted to 106.4 million tons, of which 73 million tons were coal. Imports totaled 55.4 million tons. If the continental coal trade is excluded, and it should be because it is little more than a coastwise business, the oversea movement was 57.3 million tons outward and 55.4 million inward.[4]

The British Board of Trade, in its report "Shipping and Shipbuilding Industries After the War," stated that:

> A considerable part of the earnings of the steamship lines was derived from . . . inward freights . . . and British manufactures were, therefore, carried abroad at rates which could not have been accorded but for the existence of highly organised services with a considerable volume of trade in other directions. . . . "The principal freight being earned homewards enabled the lines to fix favourable rates of freight on British exports; and shippers not only had the benefit of fast modern tonnage and could rely on definite sailings at not only frequent but regular intervals, but contracts at low rates were given to associated British trade to enable it to secure foreign orders." The practice of according specially low rates of freight to British exports was, however, the exception rather than the rule in the Central American and West Indian trades where inward cargoes were less abundant.[5]

The Cases of Germany and Japan

Germany is another case in point. Before the war heavy exports of coke helped to give full cargoes for ships clearing for foreign ports, and the importation of bulky raw materials helped to defray the cost of maintaining ships, enabling them to carry out German finished products at favorable rates.

While the rapid growth of the Japanese merchant marine has been due to many factors, one of which was heavy subsidies, geographic and economic conditions favor an expansion of Japanese shipping. The volume of Japanese imports in 1913 almost balanced with the volume of exports—5.3 million tons of imports as compared with 4.6 millions tons of exports, on the basis of the more important items. The trade is perhaps nearer balanced than these figures indicate, since the import figure includes 89 per cent of the total value of imports while the export figure includes only 63 per cent of the total value of exports. It seems necessary for a country which must depend upon the importation of essential commodities to maintain a large merchant fleet. But a country which possesses abundant natural resources has not the same need; other countries will come to its doors.

It is clearly recognized that the character of the trade of a country, while a neglected factor, is not the only one. With economic and political considerations bulking large, it is not necessarily the determining factor with reference to the maintenance of a great merchant fleet. If this aspect of the problem has been overemphasized here, it is probable, to quote the words which Malthus uses with reference to his theory of population, "that having found the bow bent too much one way I was induced to bend it too much the other in order to make it straight."

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[4] *Supreme Econ. Council Monthly Bull. of Statistics*, Vol. 2, 1920–21, No. 3, p. 29; and *Annual Statement of the Trade of the United Kingdom with Foreign Countries and British Possessions*, Cd. 7968, Vol. 1, 1914, p. 319.

[5] Reports of the Departmental Committee Appointed by the Board of Trade to Consider the Position of the Shipping and Shipbuilding Industries After the War, H. M. Stationery Office, London, 1918, pp. 149–150.

Additional facts are needed, and the machinery is being set up to get them. It is only fair also to admit that some terms susceptible of several interpretations have been used and that critical consideration is needed to clarify and establish their usage. When more complete data are obtainable and analyzed, a better formulation of a theory of the influence of geographic factors on the national maintenance of a merchant fleet can be made, and considerable light will be thrown on the shipping problem now before this country.

RECENT GEOGRAPHICAL WORK IN EUROPE

By W. L. G. Joerg

Great Britain	432	Norway	469
France	438	Sweden	470
Germany	441	Finland	473
Italy	449	The Baltic States	475
Spain	454	Poland	475
Portugal	457	Czechoslovakia	477
Belgium	458	Hungary	478
The Netherlands	460	Rumania	480
Switzerland	462	Yugoslavia	482
Austria	464	Bulgaria	483
Denmark	468	Greece	483

The present article is based on observations made in 1921 while on six months' leave of absence granted by the American Geographical Society and during a sojourn in Europe ten to thirteen years before, as well as on printed sources of information. The countries visited on both occasions were England, France, Germany, Belgium, the Netherlands, Switzerland, and Italy. In addition there were visited, in 1921, Scotland and Spain, and, on the earlier occasion, the following countries (as now constituted): Denmark, Czechoslovakia, Austria, Hungary, Yugoslavia, and Rumania. The discussion, which attempts to deal with all of Europe except Russia, lays no claim to being balanced or uniform in emphasis; indeed, it only reflects what has happened to come to the writer's attention. For the inevitable omissions, and for the possible inaccuracy in statement of information learned in conversation only, the writer begs the indulgence of his fellow-workers abroad. For their many courtesies and their constant helpfulness he is deeply grateful.

On the accompanying map are shown universities giving instruction in geography and geographical societies, as the existence or non-existence of such institutions possibly best reflects the general state of development of geography in a given country. This information is compiled from the latest edition of handbooks and other publications,[1] checked from personal

[1] Especially the general handbooks: (1) Minerva: Jahrbuch der gelehrten Welt, Vol. 25 for 1921, Berlin and Leipzig, 1921; (2) Index Generalis: Annuaire général des universités, etc., 2nd issue, Paris, 1921. For the respective countries the following are valuable: (1) Athena: A Yearbook of the Learned World: The English Speaking Races, New York, 1920; (2) Les ressources du travail intellectuel en France, Paris, 1921; (3) Annuario degli istituti scientifici italiani, 2nd issue, Bologna and Rome, 1920.

Of geographical societies the only systematic list still is the one in *Geogr. Jahrbuch*, Vol. 32 for 1909, pp. 411–418. More recent information with regard to some may be found in Index Generalis for 1921, pp. 1342–1349 (incomplete list), and for individual countries in the regional handbooks referred to above; for France, in addition, in *La Géogr.*, Vol. 36, 1921, p. 141.

A general survey of the status of geography in the different countries is afforded (1) by the conference held at the University of Virginia during the American Geographical Society's Transcontinental Excursion of 1912 (Proceedings of a Called Meeting of the Scientific Section, *Univ. of Virginia Publs.: Proc. Philos. Soc.*, 1911–12, pp. 99–134, and The Conference on Geographical Education Held During the Transcontinental Excursion of 1912, *Bull. Amer. Geogr. Soc.*, Vol. 46, 1914, pp. 121–126) and (2) by the reports of progress during the last 25 years made to the Tenth International Geographical Congress at Rome, 1913 (*Atti del X Congr. Internaz. di Geogr., Roma 1913*, Rome, 1915, pp. 116–392). Cf. also pp. 135–139 of R. H. Whitbeck: Geography in American and European Universities, *Journ. of Geogr.*, Vol. 18, 1919, pp. 129–141.

observation. The point of view is, on the whole, conservative. Only universities are shown at which geography in the modern sense is taught; in some cases one or two branches only may be represented, such as phytogeography or oceanography, but at the great majority of universities shown the subject is presented completely. Of geographical societies it is intended to show only those that are doing active work (mainly, publishing), with due allowance for war interruption. Where a society maintains a number of branches, as is the case with several societies, particularly in France, only the main society is shown. For the countries other than Russia not shown on the map (Rumania, Bulgaria, Greece) the universities and geographical societies are indicated in the title. Other institutions of importance to geography, such as survey organizations and institutions devoted to related sciences, are not shown on the map; some of them are referred to in the text.

Great Britain

In keeping with her traditional liberalism, Britain, more than any other country in Europe, it would seem, is making geography serve as a medium for the more sympathetic understanding of other peoples. In England, too, as on the Continent, the subject is of course being advanced for its utilitarian value, for the knowledge that is power, but nowhere else is its ideal function being emphasized so much as in England. The late Professor Herbertson may be counted as one of the leading exponents of this view. We need only recall his last papers, "Regional Environment, Heredity, and Consciousness"[2] and "The Higher Units."[3] It is generally conceded that he was on the threshold of great things when his career was cut short. His untimely death has been a great loss. But his work goes on. Professor H. J. Fleure of the University College of Wales at Aberystwyth approaches the problem from the anthropological side, from the study of early civilizations. By studying the accumulated tradition of a people, he aims to gain an insight into their spirit.[4] Applied to the local region, this method is the essence of the "regional survey" movement,[5] which has a widespread following. By imparting an understanding of the *genius loci*, it aims to train for better citizenship. This movement is in large measure the outgrowth of the work of Professor Patrick Geddes and puts into effect the ideas of his Outlook Tower in Edinburgh, a museum of civic geography with a world outlook.[6] Professor Geddes was appointed after the war to the chair of sociology at the University of Bombay, following the fruitful application of the town-planning principles of his "Cities in Evolution" (London, 1915) to Indian

[2] *Geogr. Teacher*, Vol. 8, 1915–16, pp. 147–153.

[3] *Scientia* (published in Bologna), 1913, No. 5.

[4] Cf. "Human Geography in Western Europe," London, 1918; France: A Regional Interpretation, *Scottish Geogr. Mag.*, Vol. 32, 1916, pp. 519–534 (on both publications see *Geogr. Rev.*, Vol. 6, 1918, pp. 515–516); Countries as Personalities (address at meeting of British Assoc. Adv. Sci., Edinburgh, Sept. 12, 1921).

[5] Cf. A Conference on Regional Surveys, *Geogr. Teacher*, Vol. 8, 1915–16, pp. 89–102 and 164–172.

[6] In it are embodied some of the ideas expressed in Patrick Geddes: Note on Draft Plan for Institute of Geography, *Scottish Geogr. Mag.*, Vol. 18, 1902, pp. 142–144, with plan; and J. G. Bartholomew: A Plea for a National Institute of Geography, *ibid.*, pp. 144–148.

cities. Quite recently he has been engaged on similar work for Jerusalem.[7] Dr. J. F. Unstead, head of the geography department at Birkbeck College, University of London, is another advocate of world knowledge as a basis for

FIG. 1—Map showing the universities giving instruction in geography and the geographical societies of Western Europe. Scale, 1 : 22,500,000. To cover the same ground as the text, the following should be added: in Rumania, universities at Bukharest, Jassy, Cluj (Kolozsvár), Czernowitz, and geographical society at Bukharest; in Bulgaria, university at Sofia.

a sympathetic understanding of other peoples. As chairman of the Geographical Committee of the League of Nations Union he has been devoting himself to this problem. His views are expressed in two recent publications, a book entitled "Europe of Today" (London, 1921), the first of a series of

[7] Patrick Geddes: The City of Jerusalem, *Garden Cities and Town-Planning* (London), Vol. 11, 1921, pp. 251–254.

"Citizens of the World Geographies," and a paper on "The Study and Teaching of International Relations."[8] The study of one of the most important questions of international relations has been taken up by Professor P. M. Roxby of the University of Liverpool. In 1912–13, as Kahn Traveling Fellow, he visited China and Japan, and he is at present in China as adviser to the Chinese Government in the reorganization of the schools and colleges hitherto maintained by missionary societies. It is expected that Professor Roxby will visit the United States on his return to England this summer. He has dealt with his field of study mainly in "The Far Eastern Question in Its Geographical Setting"[9] and "Some Aspects of the Geography of China."[10]

Senior Workers in Geography

Of those who were closely associated with the creation of modern geography in Great Britain several are still active. Sir John Scott Keltie, late Secretary of the Royal Geographical Society, whose fundamental investigation of the status of geography on the Continent, undertaken in 1884 and 1885 on the Society's behalf, provided the groundwork for the action taken in introducing the subject in British universities, is still vigorous in spite of his four score years and more, as evidenced by his recent report on "The Position of Geography in British Universities"[11] and his earlier "Thirty Years' Progress in Geographical Education."[12] Sir H. J. Mackinder, who preceded Herbertson as Reader at Oxford, has remained, as member of Parliament, loyal to our subject. His suggestive book "Democratic Ideals and Reality" (London, 1919),[13] indeed, is a fruitful application of the geographical viewpoint to political questions. His continued activity on behalf of the advancement of geography is betokened by his "Presidential Address to the Geographical Association, 1916"[14] and "Geography as a Pivotal Subject in Education."[15] Dr. H. R. Mill, the veteran Director of the British Rainfall Organization, whose failing eyesight forced him to relinquish that position in 1919, has fortunately so recovered that he is again able to be an active participant in geographical meetings. His recent Herbertson Memorial Lecture, "The Value of Regional Geography,"[16] will be read with interest, not the least because of its reminiscent strain.

Geography at the Universities

As regards the present representation of geography at the universities: sixteen out of a total of eighteen in Great Britain include the subject in their

[8] *Geogr. Teacher*, Vol. 11, 1921–22, pp. 136–140.

[9] *Geogr. Teacher*, Vol. 10, 1919–20, pp. 82-90, 142–150, and 253–269, with map on p. 270 (abstracted in the *Geogr. Rev.*, Vol. 12, 1922, pp. 138–139).

[10] *Ibid.*, Vol. 8, 1915–16, pp. 1–5.

[11] *Amer. Geogr. Soc. Research Series No. 4*, New York, 1921.

[12] *Geogr. Teacher*, Vol. 7, 1913–14, pp. 215–227.

[13] Cf. F. J. Teggart: Geography as an Aid to Statecraft: An Appreciation of Mackinder's "Democratic Ideals and Reality," *Geogr. Rev.*, Vol. 8, 1919, pp. 237–242.

[14] *Geogr. Teacher*, Vol. 8, 1915–16, pp. 271–277.

[15] *Geogr. Journ.*, Vol. 57, 1921, pp. 376–384.

[16] *Geogr. Teacher*, Vol. 11, 1921–22, pp. 63–75 (incorrectly numbered pp. 7–19). Noticed in *Geogr. Rev.*, Vol. 11, 1921, p. 629.

curriculum. At ten of these it is a subject for the Honours degree, i.e. a degree requiring advanced work and specialization.[17] At Oxford, which was the first and remains the best equipped School of Geography, Mr. H. O. Beckit is Reader. In addition, geography is the gainer by the work of Professor J. L. Myres in the relations of history and geography and of Dr. D. G. Hogarth on the Near East. Some aspects of the war work with which Dr. Hogarth was in touch as head of the Arab Bureau in Cairo he has fascinatingly described in two articles.[18] His Presidential Address on "Applied Geography"[19] before Section E (Geography) at the Edinburgh meeting of the British Association for the Advancement of Science in September, 1921, will also be read with interest. At Cambridge the present Honours standing of geography dates from the establishment of the Geographical Tripos, in 1919.[20] Mr. Philip Lake is Reader in regional and physical geography, Mr. H. Yule Oldham lecturer in historical geography, and Mr. Frank Debenham lecturer in cartography. Mr. Debenham, who was a member of Scott's Antarctic expedition, has recently been advocating the establishment of a polar research institute.[21] Dr. A. C. Haddon's work as Reader in ethnology has much geographical bearing.

Among other universities where geography is being actively forwarded should be mentioned: the University of Liverpool, where Professor Roxby has built up a strong department, recently acquiring an entire private house, which has been made over and furnished with a wide range of equipment; the University of London, with which are connected Mr. James Fairgrieve, author of "Geography and World Power" (London, 1915), who gave a course on "The Geographical Factor in History" at the University of Chicago during the 1921 summer term, and (at University College) Professor L. W. Lyde, well known for his "The Continent of Europe" (London, 1913), as professor of economic geography; the University College of Wales at Aberystwyth, where Professor Fleure, through his courses and his editorship of the *Geographical Teacher*, is exercising marked influence on the development of geographic thought in Great Britain; the University of Leeds, where the Reader is C. B. Fawcett, whose discussion of a proposed new administrative subdivision of Great Britain on geographical lines has recently appeared in book form;[22] the University of Sheffield, where Dr.

[17] On geography in British universities cf. the valuable tabular synopsis in *Scottish Geogr. Mag.*, Vol. 37, 1921, pp. 272–273, and the account by Sir J. S. Keltie mentioned in footnote 11 as well as the synopsis in *Geogr. Teacher*, Vol. 7, 1913–14, pp. 194–209, and the previous synopses there mentioned. On British universities in general cf.: The Universities of the United Kingdom of Great Britain and Ireland: A Handbook Compiled by the Universities Bureau of the British Empire, *Board of Education Educational Pamphlet No. 33*, London, 1918 (prepared on the occasion of the visit of delegates from British universities to American universities at the invitation of the Council of National Defense).

[18] War and Discovery in Arabia, *Geogr. Journ.*, Vol. 55, 1920, pp. 422–439; Some Recent Arabian Explorations, *Geogr. Rev.*, Vol. 11, 1921, pp. 321–337.

[19] E.g. in *Scientific Monthly*, Vol. 13, 1921, pp. 322–327.

[20] Cf. Philip Lake: The Geographical School at Cambridge, *Geogr. Teacher*, Vol. 10, 1919, pp. 80–81; and W. M. Davis: Geography at Cambridge University, England, *Journ. of Geogr.*, Vol. 19, 1920, pp. 207–210.

[21] Frank Debenham: The Future of Polar Exploration, *Geogr. Journ.*, Vol. 57, 1921, pp. 182–204.

[22] Provinces of England: A Study of Some Geographical Aspects of Devolution, London, 1919 (expanded from Natural Divisions of England, *Geogr. Journ.*, Vol. 49, 1917, pp. 124–141, abstracted in *Geogr. Rev.*, Vol. 7, 1919, pp. 114–115, with map).

R. N. Rudmose Brown, who has specialized in Spitsbergen,[23] is head of the department; the University College, Southampton, at which Professor W. H. Barker has been developing an Institute of Geographical Study, favored by the proximity of the Ordnance Survey and the world "clearing-house" function of the port; the University of Edinburgh, at which geography has long been represented by Mr. G. G. Chisholm, who is at present producing a new edition of his well-known "Handbook of Commercial Geography"; and the University of Aberdeen, at which Mr. John Macfarlane is lecturer in geography. The old-established geography department at the Victoria University of Manchester has, since Mr. A. G. Ogilvie joined the staff of the American Geographical Society, unfortunately been without a head; but this condition will soon be changed, as, it is understood, Professor Barker has accepted a call to go there.

Work of Institutions

Institutions other than universities are, of course, contributing to the advancement of geography in Great Britain. Of the Royal Geographical Society's work there can only be mentioned the Mt. Everest expedition, the recently inaugurated Technical Series,[24] and the war-time production, in co-operation with the Geographical Section of the General Staff, of a map on the scale of 1 : 1,000,000 covering practically all of Europe and the Near East, which took the place of the—for the greater part of the area—non-existent International Map of the World and which did substantial service during the war. The war work of the Ordnance Survey is described in "The Ordnance Survey and the War, 1914–1919," published by the Survey in Southampton in 1919. The position of Archeology Officer, recently created on the staff of the Survey, is filled by Mr. O. G. S. Crawford, author of "Man and His Past" (London, 1921) and the article "Prehistoric Geography" in the *Geographical Review* for April. His duties involve the search for and indentification of ancient remains, including prehistoric barrows and Roman sites, and their plotting on the six-inches-to-the-mile map. The Ordnance Survey, as the Central Bureau, has also recently published a report, with index maps, on the status of the International Map of the World.[25] Of the various war and peace conference publications of government bureaus the most important are the two series of handbooks on the problem areas of the world compiled by the Historical Section of the Foreign Office[26] and the Geographical Section of the Naval Intelligence

[23] The substance of several articles (e. g. Spitsbergen: Terra Nullius, *Geogr. Rev.*, Vol. 7, 1919, pp. 311–321) is contained in Dr. Rudmose Brown's book "Spitsbergen," Philadelphia, 1920.

[24] No. 1: Some Investigations in the Theory of Map Projections, by A. E. Young; No. 2: Alphabets of Foreign Languages Transcribed Into English According to the R. G. S. II System, by Major-General Lord Edward Gleichen and J. H. Reynolds.

[25] Carte du Monde au Millionième: Rapport pour 1921, Bureau Central, Ordnance Survey Office, Southampton.

[26] For a list see *Geogr. Teacher*, Vol 10, 1919-20, p. 311. See also *Geogr. Journ.*, Vol. 56, 1920, pp. 216–219 and 314–316.

Division.[27] New geographical work on the far-flung battle lines of the world war,[28] and airplane mapping,[29] are reflected in many articles.

Mention should be made of the admirable Edinburgh (Aug.-Sept.-Oct. 1919) and Glasgow (Jan. 1921) numbers of the *Scottish Geographical Magazine*,[30] the former with a suggestive map of the historical growth of the city by the late Dr. J. G. Bartholomew, which formed a valuable corollary to the discussion of "The Geography of Edinburgh and District: Past, Present, and Future Outlook" at a session of Section E of the Edinburgh meeting of the British Association and to the handbook issued on that occasion.[31] At that meeting Dr. Marion I. Newbigin, editor of the magazine, read an illuminating paper on "The Mediterranean City-State in Dalmatia." From her earlier general discussion of Balkan geography, of which this paper represented a special problem, she has recently proceeded to a geographical consideration of the peace settlements.[32]

One of the last undertakings to which the late Dr. Bartholomew was able to devote his attention is the "Times Survey Atlas of the World" (London, 1921), recently completed. The use throughout the atlas of the layer method to represent relief, of which he was the leading exponent,[33] is a distinctive contribution, which for the first time in a work of this type makes this fundamentally important geographical element easily understandable by the general public. Among other outstanding British map publications may be mentioned the recent (London, 1922) series, by Mr. George Philip, of wall maps of the continents showing commercial development, which carry out, with refinement of method, the suggestive manner of portraying the facts of economic geography which he outlined some years ago.[34] Of interest to American teachers is the recent publication, under his editorship, of a set of maps of the United States in 1:4,500,000, in the series by Unstead and Taylor in which there is a map for each of the significant phases of the geography of each continent.

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[27] For a list see *Geogr. Teacher*, Vol. 11, 1921–22, p. 39 (the issue containing this page is incorrectly allotted to Vol. 12) and p. 113 (incorrectly numbered p. 57). See also *Geogr. Journ.*, Vol. 57, 1921, pp. 51–52.

[28] H. St. J. B. Philby, *Geogr. Journ.*, Vol. 55, 1920, and Vol. 56, 1920; E. H. Keeling, *ibid.*, Vol. 55, 1920; L. C. Dunsterville, *ibid.*, Vol. 57, 1921; Percy Sykes, *ibid.*, Vol. 58, 1921; L. V. S. Blacker, *ibid.*, Vol. 58, 1921; and three systematic papers by A. G. Ogilvie: Notes on the Geography of Imbros, *Geogr. Journ.*, Vol. 48, 1916, pp. 130–145; A Contribution to the Geography of Macedonia, *ibid.*, Vol. 55, 1920, pp. 1–34; Physiography and Settlements in Southern Macedonia, *Geogr. Rev.*, Vol. 11, 1921, pp. 172–197.

[29] H. H. Thomas, *Geogr. Journ.*, Vol. 55, 1920; H. A. Lloyd, *ibid.*, Vol. 56, 1920; S. F. Newcombe, *ibid.*, Vol. 56, 1920; E. M. Dowson, *ibid.*, Vol. 58, 1921.

[30] See note in *Geogr. Rev.*, Vol. 11, 1921, pp. 298–299.

[31] Edinburgh's Place in Scientific Progress. Prepared for the Edinburgh Meeting of the British Association by the Local Editorial Committee, Edinburgh and London, 1921. (With chapters on meteorology, geology, oceanography, and geography.)

[32] Aftermath: A Geographical Study of the Peace Terms, Edinburgh, 1920 (reviewed in the *Geogr. Rev.*, Vol. 11, 1921, p. 452).

[33] An appreciation of Dr. Bartholomew's contribution to cartography appears in the obituary notice, *Scottish Geogr. Mag.*, Vol. 36, 1920, pp. 183–185.

[34] A New Series of Economic Maps for School Use, *Geogr. Journ.*, Vol. 50, 1917, pp. 438–447, with map, Eurasia: Commercial Development, 1:40,000,000.

France

Let us now turn to France.[35] Geography is represented, and well represented, at practically all of the sixteen universities of France.[36] Nearly all the occupants of the chairs of geography are pupils, or pupils of pupils, of the late Vidal de la Blache.[37] In no country, it may be said, not even in Germany with her Richthofen, has the development of modern geography so centered about one man as in France. And France may be content. The school that she has developed is the admiration of professional geographers the world over. The national ideals of unity and beauty, translated in the scientific world into synthesis and sense of proportion, are peculiarly valuable in geographic work. From this school has come, and is coming, that excellent series of regional studies of France,[38] introduced by Vidal de la Blache's own admirable "La France: Tableau géographique."

Recognizing that an adequate regional treatment of the world is the fundamental desideratum of modern geography, the leading French geographers had, some years before the war, begun on a series of regional geographies intended to cover the world, in which each region or country was assigned to a specialist.[39] Several of the volumes were already in manuscript when the war broke out and completely stopped the undertaking. Now, fortunately, it is possible to proceed again, and we may within reasonable time look forward to regional geographies of the first order from such men as Gallois, De Martonne, Demangeon, and others.

Bibliographies

Another fundamental undertaking of the French, the annual bibliography of the *Annales de Géographie*, suppressed by the war since the volume covering 1913–14, has again been taken up. A volume covering 1915–19 has just appeared, edited by Monsieur Elicio Colin, as Monsieur Louis Raveneau, the veteran bibliographer, felt compelled to relinquish the editorship. Its appearance is in part made possible by a subsidy from the "Association de Géographes Français," a recently founded organization of professional

[35] For an excellent brief account of the development of geography in France, with a list of the leading works that are products of the French school, see E. de Martonne: La science géographique, pp. 375–396 of Vol. 2 of "La Science Française," 2 vols., Paris, 1915, published on the occasion of the Panama-Pacific Exposition at San Francisco.

[36] This number does not include the University of Algiers, which forms part of the French university system and at which geography is well represented, nor the five Catholic universities, at four of which (Angers, Lille, Lyons, Paris) geography is taught. For a valuable synopsis of geographical courses given at French universities, see "Cours en langue française professés pendant l'année scolaire 1921–22," *La Géogr.* (Paris), Vol. 36, 1921, pp. 555–558 (for 1920–21, *ibid.*, Vol. 34, 1920, pp. 425–427; for 1899–1900, *Ann. de Géogr.*, Vol. 9, 1900, pp. 83–85). Cf. also L. Gallois: La géographie dans l'enseignement supérieur en France, *La Geografia* (Novara), Vol. 6, 1918, pp. 495–500.

[37] On Vidal de la Blache's influence on the development of geography in France, see L. Gallois and E. de Martonne: Paul Vidal de la Blache, *Geographen Kalender*, Vol. 8, 1910, Gotha, pp. viii–xxx; and L. Gallois: Paul Vidal de la Blache, *Ann. de Géogr.*, Vol. 27, 1918, pp. 161–173.

[38] List in De Martonne, La science géographique, cited above, and *Geogr. Teacher*, Vol. 9, 1917–18, pp. 202–203.

[39] Cf. note in *Geogr. Rev.*, Vol. 1, 1916, p. 55.

geographers akin to our own Association of American Geographers and, indeed, it is understood, partly inspired by it. During the temporary lapse of this publication the bibliography compiled by S. Reizler, librarian of the Paris Geographical Society, and appearing since 1919 (Vol. 32, No. 5) in each number of its monthly organ, *La Géographie*, has, although less systematic and critical, done invaluable service.

Geography at the Sorbonne

Owing to the French system of centralization, geography is of course best represented at the University of Paris, i.e. at the Sorbonne. It is there in the tried hands of Professors L. Gallois, E. de Martonne, and A. Demangeon. Inasmuch as the subject has in France had the opposite development to what it has had with us, namely developing from history instead of from geology, in its modern aspect it is a subject belonging primarily, at all the universities, to the Faculté des Lettres. With the prestige of Paris, however, geography, as physical geography, is also represented on the Faculté des Sciences (by Professor L. Gentil).[40] But the modern conception of the subject prevails so completely that physical geography is as a matter of course included in the curriculum of the Faculté des Lettres at the Sorbonne; indeed it is there represented by Professor De Martonne. As a result of a recent gift a building has been erected in the university quarter near the Prince of Monaco's Institut Océanographique, at the corner of the rue St. Jacques and the rue Pierre Curie, and is nearing completion, for the exclusive use of the department of geography. It will house the staffs of both faculties. With this needed improvement in its physical equipment, we may look forward to even greater things from this center of French geographic learning.

The Provincial Universities

Among the leading geographers at the provincial universities may be mentioned Professor Raoul Blanchard, at Grenoble, who has built up an excellent department specializing in the geography of the Alps, the work of which is published in the *Recueil des Travaux de l'Institut de Géographie Alpine* (now *Revue de Géographie Alpine*); Professor Camena d'Almeida, at Bordeaux, who knows Spain thoroughly; and, at the new University of Strasbourg, Professor H. Baulig, the department at which, curiously behind-hand under the old régime in this former outpost of the Empire,[41] has been moved from the old German university building to the former Imperial Palace. At Strasbourg the well-known geographer-geologist, Monsieur E. de Margerie, translator and amplifier of Suess's "The Face

[40] Louis Gentil: La chaire de géographie physique de la Faculté des Sciences de Paris, *Revue Scientifique*, 1920, No. 1, 32 pp.

[41] H. Baulig: Le "Geographisches Seminar" de l'Université de Strasbourg, *Revue Internatl. de l'Enseignement*, May 15–June 15, 1920, pp. 206–211.

of the Earth," has been appointed director of the Geological Survey of Alsace-Lorraine. A second chair of geography at the university was offered to Pierre Denis, recently author of an important work on Argentina[42] which rivals his former standard "Le Brésil au XX^{ème} Siècle," but he declined, joining, instead, the staff of the Political Section of the Secretariat of the League of Nations in Geneva. At the University of Algiers geography is represented by the eminent specialists in the geography of North Africa, Professors Augustin Bernard and E. F. Gautier. Professor Gautier is at present visiting professor at Harvard University. He addressed the joint meeting of the American Geographical Society and the Association of American Geographers this spring on "Native Life in French North Africa."

Human Geography

In the field of human geography there have appeared two important works by Professor Jean Brunhes of the Collège de France, Paris, well known for his "La géographie humaine,"[43] one (jointly with Professor Camille Vallaux of the Ecole des Hautes Etudes Commerciales), "La géographie de l'histoire," a suggestive discussion of the geography of history, and the other, "Géographie humaine de la France," a preliminary volume on the human geography of France.[44] Professor Demangeon, too, has recently contributed a valuable paper in this domain, on the types of rural dwellings in France.[45] From the French school, it is understood, there may be expected in the not distant future a manual of human geography comparable to De Martonne's standard manual of physical geography. A fruitful field developed by the French is that of city geography, as witness the studies by Levainville of Rouen[46] and by Blanchard of Grenoble and Annecy.[47] A periodical was founded in 1919 by the Institut d'Histoire de Géographie et d'Economie Urbaines de la Ville de Paris, called *La Vie Urbaine*, in which papers of geographical interest appear, notably one by Louis Bonnier with a series of maps showing the growth of Paris progressively from 1800 to 1911,[48] and another on the northeastern section of Paris, with an airplane photographic map in 1 : 5,000.[49]

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[42] La République Argentine: La mise en valeur du pays, Paris, 1920 (reviewed in *Geogr. Rev.*, Vol. 11, 1921, pp. 148–149).

[43] Recently made available to English-speaking students by Isaiah Bowman and R. E. Dodge in "Human Geography," Chicago, 1920.

[44] For reviews see —— of the former: Douglas Johnson: The Geography of History: A Review, *Geogr. Rev.*, Vol. 12, 1922, pp. 278–293; of the latter: *Geogr. Rev.*, Vol. 11, 1921, pp. 430–433, and the forceful discussion by Camille Vallaux: Rivières, pays, et maisons de France, *La Géogr.*, Vol. 35, 1921, pp. 113–126.

[45] A. Demangeon: L'habitation rurale en France: Essai de classification des principaux types, *Ann. de Géogr.*, Vol. 29, 1920, pp. 352–375.

[46] J. Levainville: Rouen: Étude d'une agglomération urbaine, Paris, 1913.

[47] Grenoble: Étude de géographie urbaine, 2nd edit., Paris, 1913; Annecy: Esquisse de géographie urbaine, *Recueil des Trav. de l'Inst. de Géogr. Alpine*, Vol. 4, 1916, pp. 369–463.

[48] La population de Paris en mouvement, 1800–1911, No. 1–2, 1919, pp. 7–76; Cartes isochrones de l'agglomération parisienne, No. 3, pp. 245–250.

[49] Myriem Foncin: Belleville, No. 11, Dec. 5, 1921, pp. 391–415.

Other Work of Interest

Among other outstanding developments of interest should be mentioned the publication of the Service Géographique de l'Armée "Notices"[50] and the excellent Travaux du Comité d'Études,[51] both series, like their previously mentioned British counterparts, preparatory reports for the peace conference on the problem areas of the world; the centenary of the Paris Geographical Society, celebrated on July 4–7, 1921, under the auspices of its president, Prince Roland Bonaparte, and its secretary-general, Monsieur G. Grandidier, on which occasion a valuable history of this oldest of all geographical societies was published;[52] and, in the field of exploration, Commandant Tilho's renewed work in the Tibesti upland region of the east-central Sahara.[53]

The war work of the Service Géographique de l'Armée is discussed in two articles,[54] one by General Bourgeois, its former head. Of foremost interest are the "plans directeurs," mainly in 1 : 20,000, a series of maps, now first made available to the public, which cover the whole eastern frontier region of France. The sheets relating to the French Alps, because of their unusually large scale, afford an exceptionally valuable tool for the study of an alpine region. Of like value are the relief models in 1 : 20,000, with no vertical exaggeration, which have been made sheetwise out of this series for the whole war area from the North Sea to Switzerland. The appearance is striking of a set of the models when put together to cover a type region such as the Vosges or the eastern cuestas of the Paris Basin. Another cartographical undertaking of importance is the appearance of a new edition of the "Atlas Universel de Géographie" under the direction of the veteran geographer, Monsieur F. Schrader. In the new edition greater legibility is attained by representing relief in a different color from the line element. The valuable physical maps of the continents have been retained from the previous edition.

Germany

Germany emerges from the war with two more universities than she had before: three are newly established, Frankfort (1914), Cologne (1919), and Hamburg (1919), and one, Strasbourg, has been lost. Geography is represented by at least one full professorship at each of her universities, now twenty-three in number. An authentic count[55] of all the instructors of

[50] Notices descriptives et statistiques, Commission de Géographie du Service Géographique de l'Armée et 2e Bureau de l'État-Major de l'Armée. For list see *La Géogr.*, Vol. 33, 1920, pp. 355–356.

[51] For titles see *La Géogr.*, Vol. 33, 1920, pp. 149–154; Vol. 34, 1920, pp. 286 (last item), 289–298, *passim*, 308–311 (maps); Vol. 36, 1921, p. 104 (third item).

[52] Centenaire de la Société de Géographie, 1821–1921, 72 pp., Paris, 1921 (republished with an account of the centenary as an 151-pp. book, Paris, 1921, and in *La Géogr.*, Vol. 36, 1921, No. 2). Cf. also Notice sur la Société de Géographie, 91 pp., Paris, 1914, and note in *Geogr. Rev.*, Vol. 12, 1922, p. 143.

[53] *Geogr. Journ.*, Vol. 56, 1920, pp. 81–99, 161–183, 241–267, with map in 1:2,000,000; also *La Géogr.*, Vol. 36, 1921, pp. 295–317.

[54] Le Service Géographique de l'Armée et la cartographie de guerre, *La Géogr.*, Vol. 32, 1918–19, pp. 463–484; [J. E. R.] Bourgeois: Le Service Géographique de l'Armée pendant la guerre, *Revue Scientifique*, Nov. 27, 1920, pp. 673–684. Cf. also note "Nouvelles cartes et plans en relief de France," *Ann. de Géogr.*, Vol. 30, 1921, pp. 149–150.

geography at her universities and higher technical schools[55]—full professors, associate professors, and *privatdozenten*—reveals the formidable number of 70. The subject of investigation of these men is specifically geography. They are not geologists or historians called geographers. They often specialize, of course, in some branch of our subject, and some of the very few remaining of the oldest generation have come to it from other sciences, but all, it may be said, consider the totality of geography as their field and feel it their duty to be proficient in it. Granted the high standard—in spite of its weaknesses—of scientific work in Germany, it is in this matter of the number of its professional geographers—men with the distinctive point of view which is the essence of modern geography—and the consequent large production of truly geographical literature, that Germany's strength lies.

New Works in General Geography

Owing to this number of workers and owing also, partly, to a conscious division of labor, work is being done in Germany, it may be said, in practically every branch of general geography and on all important regions of the world. The following brief survey can, among the wealth of material, only touch upon some of the more outstanding or typical investigations that have been undertaken recently. In the field of *paleogeography* Dr. Alfred Wegener of the Deutsche Seewarte and the University of Hamburg has in a recent second edition of his book[56] amplified his migration hypothesis of continental origins, an hypothesis that has been widely discussed[57] and that seems to find confirmation in J. P. Koch's work in Greenland and W. Köppen's investigations of isostasy and pole migrations.[58] In *physiography* Professor Passarge of Hamburg has added the third volume, on the development of landforms, to the first (on landscape description) and second (on climatic, vegetational, and animal influences on the landscape) of his four-volume "Die Grundlagen der Landschaftskunde."[59] More concisely, and in a philosophic spirit, Professor Hettner of Heidelberg has recently discussed the evolution of landforms in a book[60] which gathers together and amplifies essays that had appeared in the *Geographische*

[55] Geographische . . . Vorlesungen in deutscher Sprache an den Hochschulen Mitteleuropas im Winterhalbjahr 1921–22, *Petermanns Mitt.*, Vol. 67, 1921, pp. 260–262 (geographers at German universities, 53; at German technical schools, 17; at Austrian universities and technical schools, 15; at German Swiss universities and technical schools, 5).—As to the cultural unity of the German-speaking lands see p. 464. On the general topic indicated in its title see J. Russell Smith: Geography in Germany, II: The University, *Journ. of Geogr.*, Vol. 1, 1902, pp. 448–457.

[56] A. Wegener: Die Entstehung der Kontinente und Ozeane (in series: Die Wissenschaft, Vol. 66), Brunswick, 1920.

[57] *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1921, pp. 89–143 (statement and summing up by Wegener, discussion by four specialists).

[58] W. Köppen: Über Isostasie und die Natur der Kontinente, *Geogr. Zeitschr.*, Vol. 25, 1919, pp. 39–48; Polwanderungen, Verschiebungen der Kontinente, und Klimageschichte, *Petermanns Mitt.*, Vol. 67, 1921, pp. 1–8 and 57–63, with Pl. 1; Ursachen und Wirkungen der Kontinentenverschiebungen und Polwanderungen, *ibid.*, pp. 145–149 and 191–194.

[59] Die Grundlagen der Landschaftskunde: Vol. 1, Beschreibende Landschaftskunde, 210 pp., Hamburg, 1919 (reviewed by W. M. Davis in *Geogr. Rev.*, Vol. 8, 1919, pp. 266–273); Vol. 2, Klima, Meer, Pflanzen- und Tierwelt in der Landschaft, 222 pp., Hamburg, 1920; Vol. 3, Die Oberflächengestaltung der Erde, 558 pp., Hamburg, 1920. Vol. 4, Der Mensch in der Landschaft, is announced for publication later.

[60] Die Oberflächenformen des Festlandes: Ihre Untersuchung und Darstellung, 230 pp., Leipzig, 1921.

Zeitschrift. Frankly critical of Professor Davis' views, the works of these two authors at least show to what extent those views roused and stimulated geographic thought in Germany. Of the German version of Professor Davis' "Physical Geography" a second edition in two volumes has appeared;[61] likewise the first German edition of his "Practical Exercises in Physical Geography."[62] Of Supan's standard textbook of physical geography a sixth edition appeared in 1916.[63] Supan's importance in the development of modern geography in Germany is dwelt upon in two appreciations that appeared at the time of his death in 1920.[64] Attention may also be called to a book on the relation between geological structure and surface features by Professor Karl Sapper, of the University of Würzburg, known for his work in Central America.[65] Of *manuals of general geography* new editions have appeared of part of the standard "Lehrbuch der Geographie"[66] by Professor Hermann Wagner, dean of German geographers and still active at the age of 82,[67] and of the concise and well-balanced textbook[68] by Professor W. Ule of Rostock. An entirely new work is the manual of general geography by Professor A. Philippson, one of the leading geographers of Germany, of which the first part, dealing with mathematical geography and climatology, has just appeared.[69] A valuable feature is a new classification of climatic types and climatic provinces, in text and maps. In the field of *oceanography* there should be mentioned a valuable paper on an hitherto little known region from this point of view, the Persian Gulf.[70] The author, Dr. Gerhard Schott of the Deutsche Seewarte in Hamburg, quickly followed it with a complete geographical discussion of the area,[71] similar in treatment to his admirable "Geographie des Atlantischen Ozeans." In *climatology* Professor L. Mecking of the University of Münster establishes a North Atlantic "see-saw" (*nordatlantische Wärmeschaukel*) from a study of the opposite effect on both sides of the North Atlantic of sun spot frequency (sun spot maximum, lowering of mean annual temperature on American side, raising on European, and vice versa).[72] With Köppen's

[61] W. M. Davis and Gustav Braun: Grundzüge der Physiographie, 2 vols.: Vol. 1, Grundlagen und Methodik, Leipzig, 1917; Vol. 2, Morphologie, Leipzig, 1915.

[62] W. M. Davis and Karl Oestreich: Praktische Übungen in physischer Geographie, Leipzig, 1918.

[63] Grundzüge der physischen Erdkunde, Leipzig, 1916.

[64] Hermann Wagner: Alexander Supan, *Petermanns Mitt.*, Vol. 66, 1920, pp. 139–146; Bruno Dietrich: Alexander Supan, *Geogr. Zeitschr.*, Vol. 27, 1921, pp. 193–198.

[65] Geologischer Bau und Landschaftsbild (in series: Die Wissenschaft, Vol. 61), Brunswick, 1917 (reviewed in *Geogr. Rev.*, Vol. 11, 1921, pp. 315–317).

[66] Lehrbuch der Geographie, Vol. 1: Allgemeine Erdkunde, Part 1: Einleitung, Mathematische Geographie, 10th edition, Hanover, 1920. Part 2 is in press. The 9th edition of the whole of Vol. 1 appeared in 1912.

[67] See address on his 80th birthday on retirement from chair of geography at University of Göttingen and bibliography (273 titles), *Petermanns Mitt.*, Vol. 66, 1920, pp. 115–122.

[68] Grundriss der allgemeinen Erdkunde, 2nd edition, Leipzig, 1915.

[69] A. Philippson: Grundzüge der allgemeinen Geographie. Vol. 1, Einleitung; Mathematische Geographie; Atmosphärenkunde, 270 pp., Leipzig, 1921.

[70] Oseanographie und Klimatologie des Persischen Golfes und des Golfes von Oman, 46 pp., Beilage zu *Ann. der Hydrogr. und Marit. Meteorol.*, 1918.

[71] Geographie des Persischen Golfes und seiner Randgebiete, *Mitt. Geogr. Gesell. Hamburg*, Vol. 31, 1918, pp. 1–110, with two maps, one in 1 : 4,000,000.

[72] Nordamerika, Nordeuropa, und der Golfstrom in der elfjährigen Klimaperiode, *Ann. der Hydrogr. und Marit. Meteorol.*, Vol. 46, 1918, pp. 1–9, with temperature and sun-spot frequency curves on Pl. 1.

new climatic provinces[73] readers of the *Review* are already familiar; their areas have recently been measured.[74] Köppen has also recently delimited the wind regions of the world, particularly over the ocean.[75] Noteworthy in *plant geography* are a general discussion of the tundra by Dr. A. Jacobi[76] and a map by Dr. E. Ihne, the well-known phenologist, showing the date of the beginning of spring in the British Isles[77] based on the regular phenological observations in the *Quarterly Journal of the Royal Meteorological Society*. It is an extension of his earlier map of Central Europe.[78] In the field of *human geography* the most important recent publication is Supan's manual of political geography,[79] which discusses the principles of this important branch. A related work is the book[80] by Professor Karl Dove of the University of Freiburg, which deals more with the world-regional aspect of the subject, however. An example of the studies in the history of settlement in which Professor O. Schlüter of Halle specializes is his paper on natural conditions in East Prussia before the incursion of the Teutonic Order.[81] He also discusses the method of population density maps[82] as an introduction to a map of the Rhineland by one of his pupils. The fourth in a series of population density maps covering India,[83] important because relating to the one of the two Asiatic foci for which census statistics exist, has been published. They are products of the geographical seminar in Göttingen. A discussion of man's distribution over the earth[84] by Professor Norbert Krebs of the University of Freiburg, known for his excellent regional geography of the Austrian Alps, constitutes a complete but concise manual of human geography. Professor Dove has also written concise but original manuals of economic and commercial geography.[85] In the field of agricultural geography three atlases[86] have appeared, two by Dr. T. H.

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[73] Klassifikation der Klimate nach Temperatur, Niederschlag, und Jahresverlauf, *Petermanns Mitt.*, Vol. 64, 1918, pp. 193–203 and 243–248, with map, globular scale, 1 : 60,000,000 (see R. DeC. Ward: A New Classification of Climates, *Geogr. Rev.*, Vol. 8, 1919, pp. 188–191, with map).

[74] H. Wagner: Die Flächenausdehnung der Köppenschen Klimagebiete der Erde (1918), *Petermanns Mitt.*, Vol. 67, 1921, pp. 216–217.

[75] Die Windgebiete der Weltmeere, *Ann. der Hydrogr. und Marit. Meteorol.*, Vol. 49, 1921, pp. 357–359, with map in Mercator's projection, equatorial scale, 1 : 100,000,000.

[76] Die Tundra, *Geogr. Zeitschr.*, Vol. 25, 1919, pp. 245–262.

[77] Phänologische Karte des Frühlingseinzugs auf den Britischen Inseln, *Petermanns Mitt.*, Vol. 62, 1916, pp. 81–85, with map in 1 : 5,000,000.

[78] Pl. 9, *Petermanns Mitt.*, Vol. 51, 1905, scale 1 : 3,400,000.

[79] Leitfaden der allgemeinen politischen Geographie, 140 pp., Leipzig, 1918.

[80] Allgemeine politische Geographie, 95 pp. (in series: Sammlung Göschen, No. 800), Leipzig, 1920.

[81] Wald, Sumpf, und Siedelungsland in Altpreussen vor der Ordenszeit, *Geogr. Anzeiger*, Vol. 21, 1920, pp. 245–249, with map in 1 : 500,000.

[82] Grundsätzliche Bemerkungen über Volksdichtekarten, *Petermanns Mitt.*, Vol. 66, 1920, pp. 128–129 (map of Rhineland on Pl. 24, text pp. 159–161).

[83] *Petermanns Mitt.*, as follows: Northwest Provinces, 1 : 3,000,000, 1909, Pl. 18; Upper Gangetic Plain, 1 : 2,500,000, 1911, Pl. 33; Bombay Province, 1 : 2,500,000, 1916, Pl. 33; Southern India, 1 : 2,500,000, 1917, Pl. 32.

[84] Die Verbreitung des Menschen auf der Erdoberfläche (in series: Natur und Geisteswelt, No. 632), Leipzig, 1921.

[85] Allgemeine Wirtschaftsgeographie; Allgemeine Verkehrsgeographie (in series: Sammlung Göschen, Nos. 835 and 834), Leipzig, 1921.

[86] F. Lange: Landwirtschaftlich-Statistischer Atlas, 105 maps, Berlin, 1917; T. H. Engelbrecht: Die Feldfrüchte Indiens in ihrer geographischen Verbreitung, text and atlas, *Abhandl. Hamburg. Kolonialinst.*, Vol. 19,

Engelbrecht, known for his study of the geographical distribution of the price of cereals in North America and India.

Papers Relating to the Development of Geography in Germany

Several publications relating to the development and status of geography in Germany are of interest. In a series of lectures in Berlin on the position of certain subjects in education geography was included. The lectures on geography, ten in number, by different specialists, have been published.[87] They include such topics as the unity of geography, by Hettner; geomorphology, by Philippson; plant and animal geography, by Professor R. Gradmann of the University of Erlangen, and the importance of maps, by Professor Norbert Krebs. Three papers deal with Richthofen, Theobald Fischer, and Kirchhoff as university teachers,[88] two with the courses given at Göttingen and Bonn,[89] while three memorial volumes[90] give an insight into the work of the pupils of Professors Penck, Hettner, and Eduard Hahn. The editor's retrospect over twenty-five years of the *Geographische Zeitschrift*,[91] which has had a marked influence on the development of geographic thought in Germany, may also be mentioned here. The standard German bibliography, the *Geographisches Jahrbuch*, has resumed publication, a volume having appeared which covers the war period.[92]

War Publications

Only to certain outstanding war publications can reference here be made. At the beginning of the war a series of articles by leading geographers was published in the *Geographische Zeitschrift;* these were afterwards issued separately, somewhat revised.[93] Professor Philippson discussed the Franco-Belgian area, Professor Partsch of Leipzig the eastern front, Professor Krebs the Balkan front, Professor F. Frech of Breslau the Armenian and Mesopotamian area, Professor Mecking the Channel, the North Sea, and the

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1914; *idem:* Landwirtschaftlicher Atlas des Russischen Reiches in Europa und Asien, 30 maps, Berlin, 1916.

[87] Die Geographie als Wissenschaft und Lehrfach: Zehn geographische Abende im Zentralinstitut für Erziehung und Unterricht, Berlin, 1919.

[88] A. Philippson: Ferdinand von Richtofen als akademischer Lehrer, *Geogr. Zeitschr.*, Vol. 26, 1920, pp. 257–272; Alfred Rühl: Theobald Fischer als akademischer Lehrer, *ibid.*, Vol. 27, 1921, pp. 29–33; Hans Steffen: Erinnerungen an Alfred Kirchhoff als Methodiker der Geographie und als Universitätslehrer, *ibid.*, Vol. 25, 1919, pp. 289–302.

[89] Hermann Wagner: Der geographische Universitätsunterricht in Göttingen, *ibid.*, Vol. 25, 1919, pp. 1–20 and 97–106; A. Philippson: Die Geographie an der Universität Bonn, *Die Naturwissenschaften*, Vol. 7, 1919, pp. 561–572.

[90] Festband Albrecht Penck, Stuttgart, 1918 (reviewed in *Geogr. Rev.*, Vol. 10, 1920, pp. 249–261); Zwölf länderkundliche Studien von Schülern Alfred Hettners ihrem Lehrer zum 60. Geburtstag, Breslau, 1921; Festschrift Eduard Hahn zum 60. Geburtstag, Stuttgart, 1917.

[91] Alfred Hettner: Fünfundzwanzig Jahre "Geographische Zeitschrift," *Geogr. Zeitschr.*, Vol. 26, 1920, pp. 1–8.

[92] Vol. 38 for 1915–18, Gotha, 1918–20.

[93] A. Hettner, edit.: Die Kriegsschauplätze, Leipzig, 1915–18.

Baltic. During the German occupation of Poland a Geographical Commission was appointed under the direction of Professor M. Friederichsen of the University of Königsberg, later of Dr. E. Wunderlich, at present at the School of Technology in Stuttgart on leave of absence from the University of Berlin. After preliminary publications, which included a discussion of each aspect of Russian Poland's geography, culminating in its division into natural regions,[94] a handbook was issued which constitutes a scientific regional geography of the area.[95] This was followed by a series of separate monographs, a number of which, on the vegetation of Russian Poland, on the cities of Poland and Lithuania, on the geographical source material on Poland, etc., were published[96] and others projected. Of none of the other areas occupied by the Germans was so systematic an investigation undertaken, partly because of the march of events, although Geographical Commissions were appointed in Rumania and Macedonia. Nevertheless good geographical work was carried out, as by Dr. W. Behrmann of Berlin in Rumania[97] and Dr. Walther Penck, who for a time was professor of geography at the University of Constantinople, in the Bosporus region and Asia Minor.[98] Professor Friederichsen had preceded his Polish work by an excellent little book on the marginal regions of Russia.[99] The campaigns in German Southwest Africa[100] and German East Africa[101] have been discussed from the geographical standpoint. Several articles deal with war mapping and its geographical bearing.[102] An important work which had been prepared by the German War Office before the war, but which was only released to the public after the conflict, is a contoured topographic map on the scale of 1 : 100,000 in 326 sheets of Russian Poland and the Baltic Provinces.[103] It was based on a Russian map not made public in 1 : 42,000 and 1 : 84,000, reductions of the original plane table sheets in

[94] E. Wunderlich, K. Siche, F. Pax, Ferdinand Pax, Arved Schultz, H. Praesent: Die natürliche Gliederung Polens, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1917, pp. 269–310 and 446–456.

[95] E. Wunderlich, edit.: Handbuch von Polen (Kongress-Polen): Beiträge zu einer allgemeinen Landeskunde, 2nd edit., Berlin, 1918 (reviewed in *Geogr. Rev.*, Vol. 9, 1920, pp. 215–216).

[96] Veröffentlichungen der Landeskundlichen Kommission beim Kaiserlich Deutschen Generalgouvernement Warschau: Beiträge zur Polnischen Landeskunde: Reihe A (Fachwissenschaftliche Monographieen als Ergänzungen zum Handbuch), No. 1; Reihe B (Für weitere Kreise bestimmte Einzelschriften), Nos. 1–6, Berlin, 1917–18.

[97] Die Landschaften Rumäniens, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1919, pp. 29–45, with physiographic map.

[98] E. g. Grundzüge der Geologie des Bosporus, *Veröffentl. Inst. für Meereskunde Univ. Berlin: N. F., Geogr.-naturwiss. Reihe No. 4*, Berlin, 1919; Bau und Oberflächenformen der Dardanellenlandschaft, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1917, pp. 30–49; Zur Landeskunde von Thrazien, *ibid.*, 1919, pp. 358–370.

[99] Die Grenzmarken des Europäischen Russlands: Ihre geographische Eigenart und ihre Bedeutung für den Weltkrieg, Hamburg, 1915 (reviewed in *Geogr. Rev.*, Vol. 1, 1916, pp. 473–474).

[100] Fritz Jaeger: Deutsch Südwest-Afrika als Kriegsschauplatz, *Geogr. Zeitschr.*, Vol. 26, 1920, pp. 201–206.

[101] E. Krenkel: Der ostafrikanische Kriegsschauplatz, *ibid.*, pp. 105–117, with map; Gov. Schnee: Deutsch-Ostafrika während des Weltkrieges, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1919, pp. 1–17.

[102] Max Eckert: Die Kartographie im Kriege, *Geogr. Zeitschr.*, Vol. 26, 1920, pp. 273–286, 316–324, Vol. 27, 1921, pp. 18–28; *idem:* Luftbildaufnahme und Kartenherstellung, *ibid.*, Vol. 27, 1921, pp. 241–260; E. Fels: Das Kriegsvermessungswesen in Dienste der Geographie, *Petermanns Mitt.*, Vol. 65, 1919, pp. 81–89; E. Ewald: Die Flugzeugphotographie im Dienste der Geographie, *ibid.*, Vol. 66, 1920, pp. 1–6.

[103] Karte des westlichen Russlands, 1 : 100,000, 326 sheets. Bearbeitet von der Kartographischen Abteilung der Landesaufnahme. Index map in 1 : 2,750,000, in catalogue entitled "Karten und wissenschaftliche Veröffentlichungen der Landesaufnahme," Berlin, 1920. Sections from this map will be found in "Handbuch von Polen," 2nd edit., Pls. 1, 2, 4, 5, 7.

1 : 21,000,[104] and formed a direct continuation, on the same scale, of the topographic map of Germany. It is understood that both armies, the Russian and the German, fought by it, the former by the original, the latter by the recompilation.

Work in Regional Geography

In the field of regional geography several systematic works may be mentioned. With different emphasis Professors W. Ule and Gustav Braun have treated the geography of Germany.[105] In a shorter work on a related topic[106] Professor Braun has outlined the methods followed in the larger book. In the model series of regional geographies edited by Professor Penck, which began with Professor Krebs's excellent book on the Austrian Alps,[107] a second volume has appeared, by Professor Machatschek of Prague, on Russian Turkestan (see footnote 382). Volumes are contemplated, it is understood, on the East Indies by Professor W. Volz of Breslau, on the Aegean region by Professor Philippson, and on the Low Countries by Professor Oestreich of Utrecht. Professor Hettner, always a strong advocate of regional geography as the main aim of geographical investigation—a conviction shared by the majority of leading geographers of Germany—will soon publish the section on Asia in his standard "Grundzüge der Länderkunde." At the same time abridged editions of this and the previously published section on Europe will appear. His geography of Russia, originally published in 1905, has appeared much enlarged in a third edition.[108] Early in the war Professor Philippson published a brief geography of Turkey[109] which has been characterized as exemplary. He has recently published a series of maps in 1 : 900,000, with notes, summarizing the results of his comprehensive studies in western Asia Minor. They show relief, physiography, vegetation, and ethnography.[110] In this connection mention should be made of a map of Asiatic Turkey, with substantiating text, showing the status of topographical knowledge of that area in 1914.[111] It shows in greater detail, both as to quality of survey and scale, what was represented on an

[104] Handbuch von Polen, 2nd edit., pp. 24–25.

[105] W. Ule: Das Deutsche Reich: Eine geographische Landeskunde, Leipzig, 1915; G. Braun: Deutschland, dargestellt auf Grund eigener Beobachtung, der Karten, und der Literatur, 1 vol. text, 1 vol. maps and diagrs., Berlin, 1916 (reviewed in *Geogr. Rev.*, Vol. 10, 1920, pp. 52–53).

[106] Mitteleuropa und seine Grenzmarken: Ein Hilfsbuch für geographische Studien und Exkursionen (in series: Wissenschaft und Bildung, No. 141), Leipzig, 1917.

[107] Länderkunde der österreichischen Alpen, Stuttgart, 1913 (reviewed in *Geogr. Rev.*, Vol. 2, 1916, pp. 317–319).

[108] Russland: Eine geographische Betrachtung von Volk, Staat, und Kultur: Dritte erweiterte Auflage des Werkes "Das europäische Russland," Leipzig, 1916.

[109] Das türkische Reich: Eine geographische Übersicht (in series: Deutsche Orient Bücherei, No. 12), Weimar, 1915.

[110] In *Petermanns Mitt.*, as follows: relief in altitude tints, Vol. 67, 1921, Pl. 9 (text p. 123); physiography, Vol. 66, 1920, Pl. 31 (text, pp. 197–202); vegetation, Vol. 65, 1919, Pl. 18 (text, pp. 168–173, 204–207); ethnography, *ibid.*, Pl. 3 (text pp. 17–19).

[111] H. Fischer: Geschichte der Kartographie von Vorderasien, *Petermanns Mitt.*, Vol. 66, 1920, pp. 82–89, 164–166, 203–205, 219–225, with map in 1 : 3,700,000.

earlier map by Dr. Hogarth.[112] A considerable portion of the area correctly marked on the present map as unexplored or based on reconnaissance maps only, especially in Armenia and Kurdistan, has since been covered by the valuable contoured topographic map in 1 : 200,000, based on original surveys, which was published by the Turkish General Staff during the war. Germany's interest in the geography of her Near Eastern ally is further betokened by a book by E. Banse,[113] with which readers of the *Review* are familiar from its division of the area into natural regions, and by one by Professor Kurt Hassert of the Polytechnic Institute of Dresden, which emphasizes the economic geography.[114] Among a younger group of geographers who have specialized in certain regions from personal observation may be mentioned Professor F. Thorbecke of the University of Cologne, the publication of the results of whose travels in Cameroons have recently been completed;[115] Dr. Leo Waibel, also of Cologne, who has caught the spirit of the South African veld;[116] Dr. Arved Schultz, who knows the Pamir and Turkestan;[117] and Dr. Richard Pohle, who deals with Eastern Europe and Siberia.[118] The late Professor Emil Deckert of the University of Frankfort contributed two studies during the war in his special field, the economic geography of the Anglo-Saxon world.[119] Professor Hassert has also recently written an economic geography of the United States,[120] in the preparation of which he had the assistance of Dr. Martha Krug Genthe, the German geographer who lived for a time in the United States. Of the geography of South America by Professor W. Sievers of the University of Giessen, the leading German authority on that subject, who died in June 1921,[121] a third edition appeared in 1914.[122] A new (tenth) edition of Stieler's atlas is in preparation[123] which involves a thorough revision;

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[112] D. G. Hogarth: Problems in Exploration: I, Western Asia, *Geogr. Journ.*, Vol. 32, 1908, pp. 549–570, with map in 1 : 10,000,000.

[113] Die Türkei: Eine moderne Geographie, with map in 1 : 5,000,000, Brunswick, 1919 (see E. C. Semple: The Regional Geography of Turkey: A Review of Banse's Work, *Geogr. Rev.*, Vol. 11, 1921, pp. 338–350, with map, 1 : 7,000,000).

[114] Das Türkische Reich, politisch, geographisch, und wirtschaftlich, Tübingen, 1918.

[115] Im Hochland von Mittel-Kamerun, in 3 parts, *Abhandl. Hamburg. Kolonialinst.*, Vols. 21, 36, 41, Hamburg, 1914, 1916, 1919. See also his Das tropische West- und Mittel-Afrika, *Geogr. Zeitschr.*, Vol. 21, 1915 pp. 372–394 and 443–453.

[116] Der Mensch im südafrikanischen Veld, *Geogr. Zeitschr.*, Vol. 26, 1920, pp. 26–50 and 79–89; see also his book Urwald, Veld, Wüste, 206 pp., Breslau, 1921.

[117] E.g. Landeskundliche Forschungen in Pamir, *Abhandl. Hamburg. Kolonialinst.*, Vol. 33, 1916; Die natürlichen Landschaften von Russisch Turkestan, *Abhandl. aus dem Gebiet der Auslandskunde, Hamburg. Univ.* (continuation of preceding series), Vol. 2, 1920 (reviewed in *Geogr. Rev.*, Vol. 12, 1922, pp. 151–152).

[118] R. Pohle and H. Heyde: Völkerkarte von Osteuropa, 1 : 6,000,000, Berlin, [1919]; R. Pohle: Beiträge zur Kenntnis der westsibirischen Tiefebene, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1918, p. 1 ff., 1919, pp. 305–442; *idem:* Sibirien als Wirtschaftsraum, 66 pp., Bonn, 1921 (reviewed in *Geogr. Rev.*, Vol. 12, 1922, pp. 149–151).

[119] Die Länder Nordamerikas in ihrer wirtschaftsgeographischen Ausrüstung, Vienna, 1916; Das britische Weltreich: Ein politisch- und wirtschaftsgeographisches Charakterbild, Vienna, 1916.

[120] Die Vereinigten Staaten von Amerika als politische und wirtschaftliche Weltmacht geographisch betrachtet, 315 pp., Tübingen, 1922.

[121] See biographical notice in *Petermanns Mitt.*, Vol. 67, 1921, p. 163.

[122] Süd- und Mittelamerika (in series: Allgemeine Länderkunde edit. by W. Sievers), 3rd edit., Leipzig, 1914 (reviewed in *Geogr. Rev.*, Vol. 6, 1918, p. 439).

[123] H. Haack: Die Hundertjahr-Ausgabe von Stielers Handatlas, *Petermanns Mitt.*, Vol. 67, 1921, pp. 19–22, with sample map on Pl. 3.

for instance, the sheets for the United States are being redrawn from reductions of the topographic sheets of the U. S. Geological Survey where available. A new (seventh) edition has also appeared of Andree's Handatlas; likewise Danish-Norwegian and Swedish editions.

Post-War Arrangements

After a lapse of seven instead of the customary two years the twentieth Meeting of German Geographers was held in Leipzig in May, 1921.[124] The majority of the topics discussed in the papers presented have already, in mentioning the work of various geographers, been indirectly touched upon. Reference to several arrangements resulting from post-war conditions may, however, be of interest. For greater economy of effort and better co-operation a union of all the German and Austrian geographical societies has been created. Similarly, resolutions were passed to establish a central clearing house for foreign periodicals, from which each institution not receiving certain series and unable to subscribe for them may borrow the desired publications. As to German production, at least doctor's dissertations are curtailed for the present, as the universities have, because of the high cost, waived the requirement that they be printed. Another resolution passed calls on German map publishers to show the territories lost by Germany, including her former colonies, on all maps of the relevant areas, including school maps. In connection with the meeting there was an exhibition at the Deutsche Bücherei, a new library building which was built in 1913–16 to accommodate all publications in German from 1913 on. Two special publications deal with the map collection of the library and with the map exhibits prepared for the meeting.[125]

Italy

Of two of the four countries of Europe which lead in geography we now have excellent modern accounts of the development of the subject: one, concise, on France, by Professor de Martonne, to which reference has already been made;[126] the other, somewhat fuller, on Italy, by Professor Roberto Almagià of the University of Rome.[127] Each contains an invaluable list of the most important contributions to geography produced in that country; the works thus grouped together for each country practically constitute the body of its modern geographic thought. Professor Almagià's book makes it unnecessary here even to outline Italy's development, so illuminating

[124] For an account see P. Langhans and H. Degner: Die 20. Tagung des Deutschen Geographentages zu Leipzig in der Pfingstwoche, 1921, *Petermanns Mitt.*, Vol. 67, 1921, pp. 117–122 and 150–152.

[125] Hans Praesent, edit: Beiträge zur deutschen Kartographie, im Auftrage der Deutschen Bücherei herausgegeben, 160 pp., Leipzig, 1921; Geographische Ausstellung des Deutschen Buchgewerbevereins, mit Beiträgen zur Entwicklung des Hand- und Schulatlas, des Reisehandbuches, und des geographischen Schulbuches, 57 pp., Leipzig, 1921.

[126] Under "France," footnote 35.

[127] La geografia (series: Profili Bibliografici de l'Italia Che Scrive), 109 pp., Istituto per la Propaganda della Cultura Italiana, Rome, 1919.

and so encouraging for other countries that are striving to reach a higher status in our subject. Suffice it here to say that, as in France, this development centers mainly about one man, Giuseppe Dalla Vedova.[128] Like his French contemporary, Vidal de la Blache, he had the satisfaction of seeing his work carried on in the hands of his pupils—and these include the majority of the men who are advancing the subject in Italy today. He died in 1919 at the age of 85.[129] Another who helped usher in the new movement was Giovanni Marinelli (1846–1900),[130] known for his comprehensive compendium of general and regional geography ("La Terra," 8 vols., Milan, 1883–1901). The second volume of his collected papers, [131] on the geography of Italy and pedagogical questions, has recently appeared.

Geography is represented at twelve of Italy's universities. This practically constitutes the maximum number possible, as, in its modern aspect as a unit subject, it comes under the jurisdiction of the Faculty of Letters and, of the twenty-one Italian universities (including the four "free" universities), nine have no Faculty of Letters. One of the twelve (Parma) has no geography in the Faculty of Letters; the subject is there only represented as physical geography in the Faculty of Science. Except for this vacancy, geography enjoys maximum representation at the universities. In addition it is taught at several other higher institutions. This condition is indicative of the high state of development of geography in Italy.

Geography in Rome

At the University of Rome Professor Almagià occupies the chair of geography.[132] He is a pupil of Dalla Vedova and has been productive in many branches of geography, but more particularly on the historical and human sides. He has written on the theory of tides in antiquity and the Middle Ages and dealt with the history of Italian cartography.[133] Among

[128] A selection from his works, with a complete list of his writings to 1912 is given in: Giuseppe Dalla Vedova: Scritti geografici (1863–1913) scelti, coordinati, e ripubblicati a cura d'un comitato di geografici, Novara and Rome, 1914. His last work should also be consulted: La geografia nella vita e nella scuola moderna, *Nuova Antologia*, August, 1918. Some of the work of his pupils is illustrated in the memorial volume on the fiftieth anniversary of his career as a teacher: Scritti di geografia e di storia della geografia concernenti l'Italia pubblicati in onore di Giuseppe Dalla Vedova, Florence, 1908.

[129] For biographies see Filippo Porena: Giuseppe Dalla Vedova, *Geographen Kalender*, Vol. 5, 1907, Gotha, pp. 2–27; *idem:* L'Opera di Giuseppe Dalla Vedova, in the memorial volume mentioned in the preceding footnote, pp. ix–xxxi; L. F. De Magistris: Giuseppe Dalla Vedova, 16 pp., *Calendario-Atlante De Agostini* for 1914, Novara, 1914; Roberto Almagià: Giuseppe Dalla Vedova, *Boll. Reale Soc. Geogr. Ital.*, Vol. 57, 1920, pp. 31–50.

[130] Cf. the biography by Attilio Mori, *Riv. Geogr. Didatt.*, Vol. 1, 1917, No. 1, in the series published by that journal on the leading geographers of the last fifty years.

[131] Scritti minori di Giovanni Marinelli: Vol. 1, Metodo e storia della geografia, Florence, 1908; Vol. 2, Geografia italiana e questione didattiche, Florence, 1921.

[132] On the geography department at Rome cf. Roberto Almagià: Il gabinetto di geografia della R. Università di Roma, 13 pp., Città di Castello, 1921. On his appointment to the chair in Rome see *La Geografia* (Novara), Vol. 4, 1916, pp. 146–147. The reports of the nominating committees there reproduced (pp. 140–147) from the official bulletin of the Ministry of Public Instruction give an insight into the work of several of the leading geographers at the universities.

[133] La dottrina della marea nell'antichità classica e nel Medio Evo, 139 pp., *Mem. Reale Accad. Lincei: Classe Sci. Fis.*, Rome, 1905; La cartografia dell' Italia nel Cinquecento, *Riv. Geogr. Ital.*, Vol. 21, 1914, pp. 640–653; Vol. 22, 1915, pp. 1–26.

his recent publications are a succinct life of Columbus treated in a geographical manner,[134] and a paper on the content of human geography.[135] Lectures on meteorology are given at the university by Dr. Filippo Eredia of the Italian Meteorological Office, who has recently written on the climate of Tripoli and the rainfall of Palestine.[136] The representative of geography at the Normal School in Rome, Professor Assunto Mori, has made a distinctive contribution in publishing a systematic atlas in which the various elements of geography, such as relief, climate, human distribution, economic conditions are represented both as general phenomena and in their application to different regions. The volume so far published[137] covers general geography and western and southern Europe.

Florence as a Geographical Center

Florence is one of the most important geographical centers in Italy. At the Institute of Higher Studies geography is represented by Professor Olinto Marinelli, son of Giovanni Marinelli, and known for his numerous and fruitful investigations. As joint editor, with Professor Attilio Mori of the University of Messina, of the *Revista Geografica Italiana*, he has exercised great influence on the development of modern geography in Italy. Of his numerous recent publications there can only be mentioned two physiographic studies,[138] several papers dealing with the conception of the natural region,[139] a paper on the peoples of the contact zone of northern Italy from Nice to the Quarnero,[140] an economic classification of cities,[141] and a history of the development of isometric lines, such as isotherms, etc.[142] Associated with Professor Marinelli are Professors Sebastian Crinò and Luigi Giannitrapani. Professor Crinò, author of an anthropogeographic study of Etna,[143] is the editor of a new journal devoted to the teaching of geography, *Rivista di Geografia Didattica*, which has appeared since 1917. A paper of his on the distribution of population over the earth[144] may be noted. Professor

[134] Cristoforo Colombo (in series: Profili), 78 pp., Rome, 1918.

[135] La geografia umana, *La Geografia*, Vol. 4, 1916, pp. 366–387.

[136] Climatologia di Tripoli e Bengasi, *Monogr. e Rapp. Colon. No. 4*, Rome, 1917; Le precipitazioni acquee in Palestina, *Boll. Reale Soc. Geogr. Ital.*, Vol. 57, 1920, pp. 259–270.

[137] Atlante di geografia fisica, politica, ed economica: Fascicolo 1, 18 plates with over 300 maps and diagrs., Turin, etc., 1918.

[138] La regione del Monte Amiata, *Mem. Geogr. No. 39*, Florence, 1919; Fenomeni carsici nelle regione gessose d'Italia, *ibid. No. 34*, 1917.

[139] Sul concetto di regione naturale, *Riv. Geogr. Didatt.*, Vol. 4, 1920, No. 5; Il Friuli come tipo di regione naturale, *ibid.*, Vol. 1, 1917; Sopra le regioni ed i confini naturali con particolari cenni relativi all'Italia, Appendix 1 (pp. 114–122) to a general paper on the geographical situation in Italy: La geografia in Italia, *Riv. Geogr. Ital.*, Vol. 23, 1916, pp. 1–24 and 113–131.

[140] The Regions of Mixed Populations in Northern Italy, *Geogr. Rev.*, Vol. 7, 1919, pp. 129–148, with ethnographic map, 1 : 1,500,000.

[141] Dei tipi economici dei centri abitati a proposito di alcune città italiane ed americane, *Riv. Geogr. Ital.*, Vol. 23, 1916, pp. 413–431.

[142] Appunti storici e didattici sulle curve isometriche, *Riv. Geogr. Didatt.*, Vol. 4, 1920, No. 6; Vol. 5, 1921, No. 1.

[143] L'Etna: Saggio antropogeografico, 28 pp., Messina, 1907.

[144] Osservazioni intorno alla distribuzione della popolazione sulla superficie terrestre, *Riv. Geogr. Didatt.*, Vol. 1, 1917.

Giannitrapani, author of a regional monograph on Savoy,[145] has dealt with the methods of study of regional geography.[146] Florence is also the headquarters of the Istituto Geografico Militare, which, under the energetic direction of General N. Vacchelli, is making valuable contributions to geography even beyond its regular output of topographic and other maps. In 1920 this office began the publication of a monthly journal called *L'Universo*, which contains geographical articles of general interest, more especially dealing with mapping. Among articles of the latter type, for example, has appeared one on material of such relatively difficult access as the topographic maps of Turkey.[147] This appropriateness of Florence made it the city that was chosen for the eighth Italian Geographical Congress, which was held there from March 29 to April 23, 1921.[148] No congress had been held since 1910, in Palermo. Dr. F. de Filippi spoke on the publication of the results of the Duke of Abruzzi's expedition to the Karakorum.[149] Count Cesare Calciati, who is a pupil of Professor Girardin of Fribourg, Switzerland, reported on his recent glacial studies during the expedition to the Himalayas under the auspices of M. Piacenza.[150] Professor Marinelli outlined the plan of a comprehensive physical and anthropological atlas of Italy, and the Italian Touring Club, well known for the publication of an admirable map of Italy in 1 : 250,000 and detailed provincial guide books of Italy, exhibited the first sheets of the large general atlas which it is bringing out.[151]

Other University Geographers

Among other leading geographers at the universities should be mentioned Professor Giotto Dainelli of Pisa, editor of *Memorie Geografiche*, the series of monographs supplementary to the *Revista Geografica Italiana*, to which he has himself recently contributed an excellent discussion, valuable from the standpoint of method, of population distribution in Tuscany,[152] besides publishing a regional study of Dalmatia with accompanying atlas;[153] Professor Carlo Errera of the University of Bologna, known for his history of the age of discovery, who has recently studied the Italian-Slav contact zone on the eastern side of the Adriatic[154] and published an excellent concise

[145] La Savoia: Monografia geografica. *Boll. Reale Soc. Geogr. Ital.*, Vol. 52, 1915, pp. 31–68.

[146] Il metodo negli studi di geografia regionale, *Riv. Geogr. Ital.*, Vol. 26, 1919, pp. 1–27. See also his: Monografie regionali, *Riv. Geogr. Didatt.*, Vol. 1, 1917, No. 4.

[147] Il Servizio Topografico nell' Impero Ottomano e la moderna cartografia turco, *L'Universo*, Vol. 1, 1920, pp. 127–136, with several maps, including indexes of the 1 : 25,000–50,000 and 1 : 200,000 series (cf. p. 448, top).

[148] *Riv. Geogr. Ital.*, Vol. 28, 1921, pp. 1–8; Roberto Almagià, *Petermanns Mitt.*, Vol. 67, 1921, p. 129.

[149] La spedizione nel Karakorum e nell' Imalaja occidentale, 1909: Relazione dell Dott. Filippo de Filippi, illustr. di Vittorio Sella, 1 vol. text and case of panoramas and maps, Bologna, 1920).

[150] Cesare Calciati: Cenno sui risultati geografici della spedizione Mario Piacenza in Himalaja, Milan, 1921, with map, 1 : 100,000, of glaciers explored.

[151] R. Almagià: Un grande atlante geografico italiano, *Riv. Geogr. Ital.*, Vol. 24, 1917, pp. 353–357; L. V. Bertarelli: L'attività geografica del Touring Club Italiano nel decennio 1910–20; Il grande Atlante Internazionale del T. C. I. (Nota per l'VIII Congr. Geogr. Ital.), 32 pp., Florence, 1921.

[152] La distribuzione della popolazione in Toscana, *Mem. Geogr. No. 33*, 260 pp., Florence, 1917, with 3 maps showing population in relation to area and altitude, and the location and size of agglomerations.

[153] La Dalmazia, 1 vol. text, 73 pp., and atlas of 22 plates with 60 maps, Novara, 1918.

[154] Italiani e Slavi nella Venezia Giulia, *Quaderni Geogr. No. 9*, Novara, 1918; La lingua dei pubblici uffici nei comuni dalmati trent' anni fa, *Riv. Geogr. Ital.*, Vol. 27, 1920, pp. 47–53.

account of Italy and its regions;[155] Professor Arrigo Lorenzi of Padua, whose latest anthropogeographical study deals with man and the forest,[156] and Professor Luigi De Marchi of the same university, who has recently added a concise manual of physical geography[157] to his earlier comprehensive treatise on that subject[158] and written a valuable discussion of the karst hydrography of the Asiago Plateau;[159] Professor Attilio Mori of Messina, who deals with population distribution in Sicily;[160] Professor C. Colamonico of Naples, who has made intensive studies of the population of the provinces of Puglia and Lecce in relation to elements of physical geography;[161] Professor Cosimo Bertacchi of Turin, who recently wrote a short paper on Armenia;[162] Professor Mario Baratta of Pavia, editor of the excellent educational journal *La Geografia*, who has recently added to his general studies of the "natural" eastern boundary of Italy in the Karst region[163] an investigation of the critical Adelsberg area.[164]

At the Accademia Scientifico-Letteraria of Milan geography is represented by Professor Giuseppe Ricchieri, who has long devoted himself to developing the methods of geography. During the war he published a paper on the geographical basis of Poland.[165] Associated with him as instructor is Paolo Revelli, who has recently written a paper on Italian influence in the development of political geography as a science[166] and a book on the relation of Italy to the Levant.[167]

Recent Publications

The following topics of other recent publications will, like the work of the men just discussed, illustrate the high state of development of geography in Italy: the glacier-slip on the Italian side of Mont Blanc in November, 1920;[168] forests in relation to stream flow (based on H. M. Chittenden);[169] the historical development, content, and present tendencies of plant geography,[170] and the phytogeographical and zoögeographical position of the

[155] L'Italia e le sue regioni, 40 pp., Bologna, 1919.

[156] L'uomo e le foreste, *Riv. Geogr. Ital.*, Vol. 25, 1918, pp. 141–180, 213–242, Vol. 26, 1919, pp. 47–57.

[157] Geografia fisica e geologia, 244 pp., Milan, 1917.

[158] Trattato di geografia fisica, 503 pp., Milan, 1902.

[159] Sull' idrografia carsica dell' Altipiano dei Sette Comuni, *Ufficio Idrogr. Pubbl. No. 22*, Venice, 1911.

[160] La distribuzione della popolazione in Sicilia e le sue variazoni negli ultimi quattro seculi, *Mem. Geogr. No. 36*, Florence, 1920.

[161] La distribuzione delle popolazione nella Puglia centrale e meridionale secondo la natura del suolo, *Boll. Reale Soc. Geogr. Ital.*, Vol. 53, 1916, pp. 201–234, 274–305, 403–429; La distribuzione della popolazione in Puglia secondo la distanza dal mare, *ibid.*, Vol. 55, 1918, pp. 373–393, 597–622, 760–780; Zona di piovosità e densità di popolazione nella provincia di Lecce, *Riv. Geogr. Ital.*, Vol. 24, 1917, pp. 161–180.

[162] L'Armenia: Una Polonia asiatica, *Quaderni Geogr. No. 2*, Novara, 1918.

[163] Confine orientale d'Italia, *Quaderni Geogr. No. 3*, Novara, 1918, with two maps, 1 : 500,000 and 1 : 250,000.

[164] La circolazione interna delle acque ed il confine orientale d'Italia, *La Geografia*, Vol. 8, 1920, pp. 124–145 (the region dealt with is shown on the 1 : 250,000 map of the publication listed in the preceding footnote).

[165] Le basi geografiche della nazione polacca, *Boll. Soc. Geogr. Ital.*, Vol. 53, 1916, pp. 306–322 and 385–402.

[166] Le origini italiane delle geografia politica, *Boll. Soc. Geogr. Ital.*, Vol. 55, 1918, pp. 118–129, 221–240, 394–416, 623–636, 728–759, Vol. 56, 1919, 230–243, 279–308, 395–422.

[167] L'Italia e il mar di Levante, 234 pp., Milan, 1917.

[168] U. Valbusa: La catastrofe del Monte Bianco e del Ghiacciaio della Brenva, *Boll. Soc. Geogr. Ital.*, Vol. 58, 1921, pp. 95–114, 151–162, with photographs.

[169] A. Scala: Influenza del bosco sul regime delle acque, *ibid.*, pp. 205–224.

[170] A. Béguinot: La fitogeografia: Sviluppo storico, contenuto, e direttive moderne, *La Geografia*, Vol. 6, 1918, pp. 322–346 and 435–465.

Adriatic region[171] (two papers of Professor Augusto Béguinot, botanist at the University of Padua); pastoral-agricultural life, *transhumance*, and provincial fairs in Piedmont;[172] the diminution of population in Basilicata;[173] mountains as language divides,[174] by Professor Francesco Musoni of the University of Padua; and the regional geography of Transcaucasia.[175]

In the field of cartography[176] mention should be made of a new advanced school atlas[177] published by the well-known Istituto Geografico De Agostini, under the editorship of its scientific director, Dr. Luigi Visintin, who studied under Brückner. A Brazilian edition of this atlas has also appeared. Achille Dardano of the Cartographic Office of the Ministry of Colonies has recently designed a symmetrical-elliptical projection for world economic maps.[178] A report on topographic mapping in Cyrenaica is of interest.[179]

Spain[180]

At the Spanish universities the dualistic conception of geography may be said to prevail, "political and descriptive geography" being taught in the Faculty of Philosophy and Letters, and "cosmography and geophysics" in the Faculty of Science. The really essential part of the subject is that taught in the Faculty of Letters;[181] it here comes under the history section. The fact that the completion of studies in this section conferred upon the graduate (*licenciado*) the title of professor of history and geography in the secondary schools and that this led to overburdening the teacher and neglecting geography[182] brought about a movement for the separation of the

[171] *Idem:* L'ipotesi dell' "Adria" nei rapporti con la corologia delle piante e degli animali, *ibid.*, Vol. 5, 1917, pp. 188–207.

[172] G. B. Roletto: Ricerche antropogeografiche sulla Val Pellice, *Mem. Geogr. No. 35*, Florence, 1918 (noticed in *Geogr. Rev.*, Vol. 7, 1919, pp. 265–266); La Valle dell' Orsigna: Appunti di geografia antropica ed economica, *Riv. Geogr. Ital.*, Vol. 23, 1916, pp. 432–440, Vol. 24, 1917, pp. 24–38; La transumanza in Piemonte, *ibid.*, Vol. 27, 1920, pp. 114–120, with map; La zona pastorale delle Valli di Lanzo, *La Geografia*, Vol. 9, 1921, pp. 1–25; Le condizione geografiche delle fiere di Pinerolo, *ibid.*, pp. 99–135.

[173] Paolo De Grazia: La diminuzione delle popolazione in Basilicata, *Boll. Soc. Geogr. Ital.*, Vol. 58, 1921, pp. 411–440 and 525–553.

[174] F. Musoni: Le linee di cresta dei sistemi montagnosi ed i confini delle aree etnico-linguistiche, *Riv. Geogr. Ital.*, Vol. 25, 1918, pp. 166–180.

[175] Silvio Govi: Transcaucasia, *L'Universo*, Vol. 1, 1920, pp. 295–319, Vol. 2, 1921, pp. 5–40, 81–120, with maps of the Caucasus region, mainly in 1 : 4,000,000, showing geology, relief, hypsometry, drainage, climate, precipitation, temperature, ethnography, types of cultivation, mineral resources, population density.

[176] See R. Almagià: La cartografia in Italia, *Riv. Geogr. Ital.*, Vol. 24, 1917, pp. 244–254.

[177] Atlante geografico metodico, 63 plates, Novara, 1921.

[178] Le proiezioni in planisfero per le carte di geografia economica, *La Geografia*, Vol. 7, 1919, pp. 24–41, with four world maps, 1 : 200,000,000, in Mollweide's, Aitoff's, Hammer's, and Dardano's projections.

[179] G. Gianni: I lavori topografici in Cirenaica, *L'Universo*, Vol. 1, 1920, pp. 387–406, with maps.

[180] On the recent development of geography in this country, see the last chapters in Becker's history of geography in Spain cited in footnote 188 and the relevant papers cited in the footnotes that follow. Among expressions of foreign thought exerting an influence on this development it is of interest to note W. S. Tower's paper on Scientific Geography in *Bull. Amer. Geogr. Soc.*, Vol. 42, 1910, pp. 801–825, which was translated in *Bol. Real. Soc. Geogr.*, Madrid, Vol. 53, 1911, pp. 129–169, by Vicente Vera, who, on Professor Beltrán y Róspide's inability to come, was substituted as Spain's representative on the American Geographical Society's Transcontinental Excursion of 1912, but was likewise unable to attend (*Rev. de Geogr. Colon. y Mercantil*, publ. by Real Soc. Geogr., Madrid, Vol. 9, 1912, pp. 196–197 and 492–493).

[181] For this reason the universities at which only "cosmography and geophysics" are represented (Granada, Oviedo, Salamanca) are not shown on the accompanying map.

[182] Cf. G. M. Vergara: Las cátedras de geografía é historia de los institutos, *Rev. de Geogr. Colon. y Mercantil*, Vol. 8, 1911, pp. 121–123.

two subjects.[183] In 1914 geography and history were by royal decree established as separate subjects of study at the reorganized normal schools; likewise at the Instituto del Cardinal Cisneros of Madrid. In 1915, on the reorganization of the higher commercial studies, a professorship in geography was created at the Escuela Central de Intendentes Mercantiles in Madrid.

In this advancement of geography in Spain much is due to the activities of the Council of the Royal Geographical Society of Madrid, and particularly of its secretary-general, Don Ricardo Beltrán y Rózpide. His report to the Minister of Education in 1913 on the teaching of geography[184] is one of the important documents of the reform movement. Professor Beltrán y Rózpide is also professor of geography at the Escuela de Estudios Superiores del Magisterio in Madrid. Of his guide to the study of geography a new edition has recently appeared.[185] Among others who have contributed to modernizing geography in Spain are: Professor Odón de Buen, effective protagonist of our subject,[186] to whose efforts is due the creation in 1914 of the Instituto Español de Oceanografía in Madrid,[187] with maritime laboratories in the Balearic Islands and at Málaga and Santander; Jerónimo Becker of the Academy of History, author, among other fundamental works, of a comprehensive history of geography in Spain down to modern times;[188] Professor Eloy Bullon of the University of Madrid, who contributed a paper on the present state of geography in Spain;[189] A. Bartolomé y Más, professor of the industry and commerce of Spain at the aforementioned Escuela Central de Intendentes Mercantiles in Madrid, whose spirited introduction[190] to the book on economic geography of A. López Sánchez, professor of economic geography at the same institution, is a patriotic plea for the advancement of geography in his country's interest; and Antonio Blázquez, librarian of the Royal Geographical Society of Madrid, whose original volume on Spain[191] in his adaptation of Vidal de la Blache and Camena d'Almeida's textbook

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[183] Cf. the letter of March 3, 1911, from the Royal Geographical Society of Madrid to the Minister of Education, *Rev. de Geogr. Colon. y Mercantil*, Vol. 8, 1911, pp. 81–84.

[184] La geografía y su enseñanza, *ibid.*, Vol. 10, 1913, pp. 409–441. Second edition published as a 42-page pamphlet, Madrid, 1920.

[185] Geografía: Guía y plan para su estudio, con especial aplicación á la geografía económica, 3 vols.: Vol. 1, 264 pp., 3rd edition; Vol. 2, 291 pp., 2nd edition, both Madrid, 1920; Vol. 3, 1st edition, 196 pp., Madrid, 1917. (See synopsis, *Rev. de Geogr. Colon. y Mercantil*, Vol. 17, 1920, pp. 363–364, and review of first edition, *ibid.*, Vol. 14, 1917, pp. 41–52.)

[186] Cf. his inaugural address at the opening of the academic year 1909–10 at the University of Barcelona: La enseñanza de la geografía en España, *Bol. Real Soc. Geogr.*, Madrid, Vol. 51, 1909, pp. 409–441 (with references to previous papers of importance in the reform movement and a plea for the consideration of oceanography), and a paper read at the fortieth anniversary of the Madrid Geographical Society: La ciencia geográfica en España, *ibid.*, Vol. 58, 1916, pp. 143–153.

[187] Cf. Odón de Buen: El Instituto Español de Oceanografía y sus primeras campañas, *Trabajos de Oceanogr.* 1, Madrid, 1916.

[188] Los estudios geográficos en España: Ensayo de una historia de la geografía, 366 pp., Real. Soc. Geogr., Madrid, 1917.

[189] Estado actual de la enseñanza de la geografía en España, *Bol. Real Soc. Geogr.*, Madrid, Vol. 58, 1916, pp. 153–170.

[190] Concepto y valor de la geografía y especialmente de la geografía económica, *Rev. de Geogr. Colon. y Mercantil*, Vol. 11, 1914, pp. 409–424.

[191] Antonio Blázquez, jointly with Delgado Aguilera: España y Portugal, Vol. 3 in Curso de Geografía por P. Vidal de la Blache, P. Camena d'Almeida y A. Blázquez adaptado á las necesidades de España y America (6 vols., Barcelona, 1913–16), Barcelona, 1914.

series on geography is one of the best modern geographies of that country.

The leading part played in the development of the modern scientific spirit in Spain by the Museo Nacional de Ciencias Naturales in Madrid under the jurisdiction of the Junta para Ampliación de Estudios é Investigaciones Científicas redounds to the benefit of geography. In the geological series of publications of the museum has appeared an excellent physical geography of the Iberian peninsula by Juan Dantín Cereceda,[192] thoroughly modern in method and spirit. Other numbers of geographical interest in the same series deal with the geology of the northern part of the peninsula, with the Quaternary glaciation of the mountains of Spain, and with the geography, including the human geography, of that important life-zone boundary, the Sierra de Guadarrama, at whose southern foot lies Madrid.[193] A product of the same school is a recent physiographic paper,[194] with block diagrams, on river capture in the Ronda basin in southern Spain. In the field of plant geography a recent book on the steppes of Spain[195] by Dr. Reyes y Prósper, professor of phytogeography at the University of Madrid, is of much interest. Among the numerous modern geographical works of Emilio H. del Villar there may be mentioned one on the subject-matter of geography and one on the "geographical value" of Spain.[196]

The recent military operations in Spanish Morocco have focused the country's attention on that region. Among timely publications may be mentioned a comprehensive history of European, especially Spanish, penetration in Morocco and a compilation of treaties and laws relating to that country by Jerónimo Becker,[197] a prize essay on the geographical, economic, and political aspects of Spanish Morocco,[198] an article by the Spanish Ambassador in London,[199] a study of the colonization problem,[200] contributions to the geology and physical geography,[201] and two maps.[202]

[192] Juan Dantín Cereceda: Resumen fisiográfico de la Península Iberica, *Trabajos Museo Cienc. Nat. No. 9*, Madrid, 1912.

[193] E. Hernández-Pacheco: Ensayo de síntesis geológica del norte de la Península Iberica, *ibid.*, No. 7, 1912; Hugo Obermaier:—Picos de Europa,—Sierra de Gredos,—Sierra Nevada,—Sierra de Guadarrama, *ibid.*: *Serie Geol.*, Nos. 9, 14, 17, 19 (see note in *Geogr. Rev.*, Vol. 2, 1916, p. 308); C. Bernaldo de Quiros: Guadarrama, *ibid.*, No. 11, 1915, with bird's-eye view by Juan Carandell.

[194] Juan Carandell: Bosquejo geográfico del tajo de Ronda (Málaga), *Rev. de Geogr. Colon. y Mercantil*, Vol. 18, 1921, pp. 41–54.

[195] E. Reyes y Prósper: Las estepas de España y su vegetación, Madrid, 1915.

[196] La definición y divisiones de la geografía dentro de su concepto unitario actual, Barcelona, 1915; El valor geográfico de España: Ensayo de ecética, 301 pp., Madrid, 1921.

[197] Historia de Marruecos: Apuntes para la historia de la penetración europea y principalmente de la española en el Norte de Africa, Madrid, 1915; Tratados, convenios y acuerdos referentes á Marruecos y á la Guinea Española, Madrid, 1918.

[198] Abelardo Merino Álvarez: Marruecos, *Bol. Real. Soc. Geogr.*, Madrid, Vol. 63, 1921, pp. 5–168 (see *Geogr. Rev.*, Vol. 11, 1921, p. 618).

[199] Alfonso Merry del Val: The Spanish Zones in Morocco, *Geogr. Journ.*, Vol. 55, 1920, pp. 329–349 and 409–422 (transl. in *Bol. Recl. Soc. Geogr.*, Madrid, Vol. 62, 1920, pp. 205–265, and noticed in *Geogr. Rev.*, Vol. 11, 1921, pp. 618–619).

[200] L. M. Peinador: El suelo de Marruecos y sus primeros habitantes: Problema hispano-marroquí, Madrid, 1920.

[201] Agustín Marin: Estudios relativos á la geología de Marruecos, *Bol. Inst. Geol. de España*, Vol. 42, Madrid, 1921; L. F. Navarro: Marruecos físico: Valor económico del protectorado español, *Rev. de Geogr. Colon. y Mercantil*, Vol. 18, 1921, pp. 221–239.

[202] Ecola y Mendez: España en Marruecos: Mapa de la zona en el norte del imperio asignada á España según el tratado de 1912, 1 : 450,000; and J. M. de Gamoneda: Mapa del Imperio de Marruecos, 1 : 600,000.

Portugal

In Portugal the chief geographical centers are the University of Lisbon and the Geographical Society of Lisbon. At the university Professor F. Silva Telles is professor of geography. Professor Telles' views on the content of geography in relation to academic work have been expressed in several papers.[203] He is also professor of climatology at the School of Tropical Medecine in Lisbon.[204] Associated with Professor Telles at the university is Professor L. F. de Lencastre Schwalbach Lucci, who has done work along modern lines both in physical and human geography. One of his papers is a methodological study of a region from the geographical point of view.[205] Many of the activities of the Geographical Society of Lisbon are associated with the name of its secretary-general, Ernesto de Vasconcellos, who is also attached to the Colonial School in Lisbon. Professor Vasconcellos was a delegate to the recent disarmament conference in Washington, and the members of the Association of American Geographers had the pleasure of hearing him read a paper on the early Portuguese discoveries at their 1921 meeting in that city. Among Professor Vasconcellos' recent publications may be mentioned a paper on Portuguese geographical work since 1889[206] and a series of geographical monographs on the Portuguese colonies, of which the numbers on the Cape Verde Islands and Portuguese Guinea have appeared.[207] Of the special publications of the Lisbon society a volume containing papers on colonial and economic questions in preparation for post-war conditions[208] is of interest. Besides these institutions geography is also represented at the School of Commerce in Lisbon, at which Professor J. G. Pereira dos Santos gives courses in economic geography; at the University of Coimbra, where Professor A. F. Carvalho teaches both geography in the Faculty of Letters and geology in the Faculty of Science; and the University of Oporto, where Professor Mendes Corrêa's anthropological work has geographical bearing, particularly his recent book on race and nationality, with special reference to Portugal.[209] A work of outstanding merit, in some phases even taking on the aspect of a social philosophy without thereby digressing from its central theme, is Dr. D. G. Dalgado's book on the climate of Portugal.[210]

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[203] L'enseignement supérieur de la géographie, *Compte Rendu Trav. IX^e Congr. Internatl. de Géogr.*, Vol. 3, pp. 271–280, Geneva, 1911; and O conceito scientifico da geografia, *Rev. Univ. Coimbra*, Vol. 4, No. 1, 1915.

[204] This aspect of his work is reflected in: Le régionalisme climatologique, *Compte Rendu Trav. IX^e Congr. Internatl. de Géogr.*, Vol. 2, pp. 473–478, Geneva, 1910.

[205] Estudo metódico de uma região no ponto de vista geográfico, Lisbon. Other works: Estudos geográficos Alterações litorais; A ria de Aveiro), 70 pp., Lisbon, 1918; Emigração e colonização, 105 pp., Lisbon, 1914.

[206] Les voyages et les travaux géographiques des portugais depuis l'année 1889, *Atti del X Congr. Internas. di Geogr.*, pp. 319–334, Rome, 1915.

[207] Colonias Portuguesas: Estudo elementar de geografia física, económica, e politica: I, Archipelago de Cabo Verde, Lisbon, 1916; II, Guiné Portugueza, Lisbon, 1917.

[208] Questões coloniais e económicas: Conclusões e pareceres, 1913–1919, 339 pp., Lisbon, 1920.

[209] Raça e nacionalidade, 187 pp., Oporto, 1920.

[210] The Climate of Portugal and Notes on Its Health Resorts, 479 pp., Lisbon, 1914 (see notice in *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 787–788).

Belgium [211]

In Belgium the development of geography at the universities may be said to be in a transitional stage, with the greater part of progress toward the modern conception of the subject accomplished, however. Geography is represented in some form at all four of the country's universities. At the University of Brussels it is closely associated with history, as it was at the French universities before the new development. It is not a degree subject in itself, but it is required for the doctorate in the "history group" in the Faculty of Philosophy and Letters.[212] It is there represented by Professors A. Hegenscheidt and C. Pergameni.[213] In the School of Political and Social Science a course is given by Professor M. Robert on the geography and anthropogeography of the Belgian Congo. To Professor M. Leriche, who gives courses in geology and physical geography in the Faculty of Science, we are indebted for a discussion of the natural regions of Belgium, exclusively on a geological basis, however.[214] Although not representing geography as such, Professor Jean Massart, the botanist, of the Faculty of Science, has, through his excursions,[215] and his phytogeographical work,[216] become one of the chief promoters of modern geography in Belgium. At the state universities of Ghent and Liége geography was put in a specially favorable position by being made, in 1900, a subject for the doctorate,[217] and, significantly enough, in the Faculty of Science. No special productivity in publication at Ghent from this development has come to the writer's notice. While Professor F. van Ortroy, the incumbent of the chair, has, in his reports to the *Geographisches Jahrbuch* from 1903 to 1912, on the progress of geography in Belgium, covered all branches of the subject, his own field of work has been mainly in political and historical geography.[218] The numbers of geographical interest in the *Recueil des Travaux Publiés par la Faculté de Philosophie et Lettres de l'Université de Gand* (No. 27, by Nees; No. 35, by Denucé; No. 44, by van Ortroy) all concern the history of geography.

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[211] For a history of the development of geographical thought in Belgium, see Jules Mees: Les sciences géographiques, pp. 225–272 of Vol. 1 of "Le mouvement scientifique en Belgique," 2 vols., Brussels, 1907.

[212] Université Libre de Bruxelles: Programme des Cours pour 1921–1922, 90 pp., Brussels, 1921; reference on p. 38.

[213] In 1913 Professor Pergameni began to give a course in the history of civilization. The following papers are an outgrowth of this work: La géographie de l'histoire: Causerie méthodologique, 22 pp., Brussels, 1913; Le milieu géographique et les principaux aspects de la civilisation japonaise, *Rev. Univ. de Bruxelles*, Vol. 26, 1920–21, pp. 185–200.

[214] Maurice Leriche: Les régions naturelles de la Belgique, *Rev. Univ. de Bruxelles*, Vol. 19, 1913–14, pp. 185–218. See also *Geogr. Rev.*, Vol. 11, 1921, pp. 583–585 (map, p. 584).

[215] Excursions scientifiques (géographie, géologie, botanique, zoologie) organisées par l'Extension de l'Université Libre de Bruxelles et dirigées par le professeur Jean Massart: I, Sur le littoral belge, *Rev. Univ. de Bruxelles*, Vol. 11, 1905–06, *passim;* II, Dans le Brabant, *ibid.*, Vols. 12, 13, 14, 1906–07, 1907–08, 1908–09, *passim;* III, Sur le bord de la Meuse, 220 pp., Brussels, 1911; IV, En Hollande, 119 pp., Brussels, 1912. Parts I (223 pp., Brussels, 1908) and II (356 pp., Brussels, 1913) have also appeared in book form.

[216] Main work: Esquisse de la géographie botanique de la Belgique (separate from *Recueil Inst. Bot. Léo Errera*, suppl. Vol. 7bis), 332 pp., with "annexe" containing photographs and maps, Brussels, 1910.

[217] Joseph Halkin: Le doctorat en géographie dans les universités belges, *Compte Rendu Trav. IX^e Congr. Internatl. de Géogr.*, Vol. 3, pp. 303–307, Geneva, 1911. Cf. also Note on the Position of Geography in Belgium, by a Belgian Professor, *Geogr. Teacher*, Vol. 10, 1919–20, p. 153.

[218] To his earlier works on the boundary treaties of Africa, Peter Apianus, and Mercator, he added, just before the war: L'œuvre cartographique de Gérard et de Corneille de Jode, *Recueil Trav. Fac. Philos. et Lettres Univ. de Gand No. 44*, Ghent, 1914.

However, at the University of Liége the new opportunity brought about a period of marked activity.[219] Under the direction of Professor Joseph Halkin, who studied for a time under Richthofen and Ratzel,[220] a modest but valuable series, *Travaux du Séminaire de Géographie de l'Université de Liége*, was begun in 1905 in which the doctor's theses and seminar papers appeared. The publication emerges from the war with renewed vitality, three numbers having been added in 1920 and 1921 to its ten pre-war issues. The titles of some of these papers betoken the modern spirit of the work being done at Liége.[221] At the Catholic University of Louvain the progressive quality of the work in geography is assured by its being in the hands of Professor P. Michotte, who has recently, basing his research on the most recent developments of the German school of thought no less than the French, published a penetrating analysis of the subject matter of geography.[222] A recent paper, product of the Louvain geography department, is also evidence of its progressive spirit.[223]

Under the auspices of the Comité National de Géographie, which was founded in 1920 and is subsidized by the Ministry of Science and Arts, the first Belgian interuniversity geographic excursion was held in September, 1921.[224] Inspired by the similar French excursions, which began in 1906, and modeled on the earlier Belgian ecological excursions conducted by Professor Massart, who also directed the present one, these excursions promise to become an important factor in the advancement of modern geography in Belgium.

Elisée Reclus' Belgian Sojourn

It may be of interest here to make some mention of Elisée Reclus' Belgian sojourn, particularly as it bears some relation to the beginning of the modern movement in that country. Possibly in connection with certain endeavors to advance the status of geography,[225] and as a result of the greater freedom, within the combination with history, allotted geography in the higher institutions of learning by a law passed in 1890–1891, the great French geographer, who had just completed his monumental "Nouvelle Géographie Universelle," was in 1892 invited to give a course in geography at the University of Brussels. This appointment came to naught, however, seemingly because of his socialistic beliefs.[226] He soon became connected with the Université

[219] Joseph Halkin: L'enseignement de la géographie à l'Université de Liége, *Trav. Sémin. de Géogr. Univ. de Liége No. 6*, Liége, 1907.

[220] From this period dates his: L'enseignement de la géographie en Allemagne et la réforme de l'enseignement géographique dans les universités belges, 171 pp., Brussels, 1900.

[221] No. 8, La rupture scandinave: Étude anthropogéographique; No. 9, La transhumance; No. 10, L'influence de la forêt sur l'homme; No. 11, Le coton au Congo belge; No. 13, La région des dunes en Belgique: Étude de géographie humaine.

[222] L'orientation nouvelle en géographie, *Bull. Soc. Royale Belge de Géogr.*, Vol. 45, 1921, pp. 5–43.

[223] Marguerite Lefèvre: Carte régionale du peuplement de la Belgique, *La Géogr.*, Vol. 36, 1921, pp. 1–34 (abstracted in *Geogr. Rev.*, Vol. 11, 1921, pp. 612–614).

[224] Program in *Bull. Soc. Royale Belge de Géogr.*, Vol. 44, 1920, pp. 254–256, and *Bull. Soc. Royale de Géogr. d'Anvers*, Vol. 41, 1921, pp. 154–157. Account in *Ann. de Géogr.*, Vol. 30, 1921, pp. 454–456; relevant maps and diagrams in *Bull. Soc. Royale Belge de Géogr.*, Vol. 45, 1921, pp. 44–59.

[225] Cf. the reform proposal in J. Du Fief: L'enseignement supérieur de la géographie en Belgique, *Bull. Soc. Royale Belge de Géogr.*, Vol. 16, 1892, pp. 225–249.

[226] Guillaume de Greef: Éloges d'Elisée Reclus et de Kellès-Kraus, Ghent, 1906, pp. 34–35; and obituary notice in *Ann. de Géogr.*, Vol. 14, 1905, p. 374.

Nouvelle of Brussels, an institution of university extension type, founded in 1891, at which he established, in 1898, an Institut Géographique.[227] This event proved of assistance to the movement for the advancement of geography, from which resulted, as outlined above, the introduction of the doctorate in geography at the state universities in 1900. The work of the institute was published in a series entitled *Publications de l'Institut Géographique de l'Université Nouvelle de Bruxelles*, of which seven numbers had appeared by 1902, one by Reclus himself.[228] To this period belongs the writing of his last work, "L'homme et la terre" (5 vols., Paris, 1905).

The Netherlands

In the Netherlands the development of modern geography[229] has suffered from the fact that, when it was introduced at the universities, the unity of the subject was not recognized.

In 1907, when the veteran geographer, Professor C. M. Kan,[230] because of reaching the age limit retired from the chair he had occupied at Amsterdam University since 1877, two chairs were established, one in physical geography in the Faculty of Science, and the other in political geography and in the geography and ethnography of the Dutch East Indies in the Faculty of Letters and Philosophy. Likewise at the University of Utrecht, in 1907, the educational authorities proposed to establish a professorship in physical geography in the Faculty of Science and an instructorship in statistical, political, economic, and general geography in the Faculty of Letters. The plan further contemplated successively appointing professors of meteorology, climatology, oceanography, ethnology, etc. This brought forth protests from professional circles, and the instructorship in political geography was made a full professorship and the multifarious professorships were abandoned. However, to this day this dualistic conception of our subject persists at the Dutch universities. At Amsterdam E. Dubois, who recently contributed a paper on the historic function of dunes of Holland as natural dikes,[231] is professor of geology and physical geography, and S. R. Steinmetz of ethnography and social geography; at Utrecht the well-known geographers K. Oestreich, who was called from Germany to occupy the chair, and J. F. Niermeyer represent respectively geomorphology and economic geography.

This division of geography in the universities is of course detrimental to

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[227] Halkin, *Trav. Sémin. de Géogr. Univ. de Liége No. 6*, p. 15. Program in *Bull. Soc. Royale Belge de Géogr.*, Vol. 22, 1898, pp. 290–294.

[228] No. 5: L'enseignement de la géographie: Globes, disques globulaires et reliefs, Brussels, 1902.

[229] For a brief sketch of this development see the first part of H. Blink: De tragedie van het hooger onderwijs in de aardrijkskunde in Nederland, *Vragen van den Dag*, Vol. 34, 1919, pp. 801–814, Amsterdam. On geography in the universities see also W. E. Boerman: Hooger onderwijs in de aardrijkskunde en de opleiding van geografen, with postscript by H. Blink, *Tijdschr. Econ. Geogr.*, Vol. 10, 1919, pp. 157–160, and H. Blink: De handelsfaculteit aan de Amsterdamsche universiteit, in verband met de aardrijkskunde aan die faculteit, *ibid.*, pp. 231–337.

[230] Died in 1919. For a biographical notice with bibliography see J. A. C. A. Timmerman: Cornelius Marius Kan, *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 36, 1919, pp. 264–280.

[231] E. Dubois: Hollands duin als natuurlijke zeewering en de tijd, *ibid.*, Vol. 33, 1916, pp. 395–415.

the subject in the secondary schools,[232] as the great majority of prospective teachers get their training at the university. A movement to remedy these conditions is under way, and the Ministry of Education, Arts, and Sciences has recently addressed letters to the Councils of the Royal Netherlands Geographical Society, the Economic Geography Association, and other interested bodies, asking for expressions of opinion.[233] An improvement in conditions may be expected to result from these steps.

At the remaining two universities of the Netherlands, Leiden and Groningen, geography is only represented by a professorship in general history and political geography (J. Huizinga) at Leiden, and the ethnographic work of Professor A. W. Nieuwenhuis, of the same institution, mainly in New Guinea. At the School of Commerce (Handelshoogeschool) of Rotterdam, however, modern geography, mainly as economic geography, forms part of the curriculum. Professor J. F. Niermeyer comes from Utrecht to give courses. The subject is there also taught by Dr. H. Blink, who came into contact with the German school as a student of Gerland. Through his creation in 1910 of the monthly journal, *Tijdschrift voor Economische Geographie*, which owes a great measure of its value to his indefatigable pen,[234] he has done much to advance the cause of geography in the Netherlands. Recently the geographic staff at Rotterdam has been augmented by W. E. Boerman.[235] The work of Professor J. C. van Erde, who has recently published a helpful summary of the ethnography of the Dutch East Indies,[236] is also of interest to geographers. At the Polytechnic Institute (Technische Hoogeschool) of Delft the work of the geologists, particularly that of a general nature on the Dutch East Indies, is of geographical bearing. To Professor G. A. F. Molengraaf we owe a valuable summary of present knowledge of the structure of the East Indian Archipelago,[237] to which a paper on the present status of hydrographic surveys[238] is a helpful corollary. Professor H. A. Brouwer, who is at present exchange professor at the University of Michigan and who addressed the joint meeting of the Association of American Geographers and the American Geographical Society this spring, has recently published some results of his 1915 expedition to the Moluccas.[239] Of other work may be men-

[232] See for example P. Goedhart: Economische geographie en het onderwijs in aardrijkskunde, *Tijdschr. Econ. Geogr.*, Vol. 11, 1920, pp. 29–31.

[233] Letter from the Ministry, dated Feb. 24, 1920, and reply of Economic Geography Association in *Tijdschr. Econ. Geogr.*, Vol. 11, 1920, pp. 441–444. See also *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 38, 1921, pp. 313–314 and 462. For later developments, see *Tijdschr. Econ. Geogr.*, Vol. 12, 1921, pp. 112 and 188.

[234] Cf. in *Tijdschr. Econ. Geogr.* regional economic geographies of the Dutch provinces of Drenthe and Limburg (Vol. 10, 1919, Nos. 2–3 and 6–7) and foreign countries of economic interest, e.g. China and Japan (Vol. 12, 1921, No. 8–9; Vol. 13, 1922, No. 1). Cf. also interesting paper on economic regions: Regionale geographie, natuurlijke landschappen en economisch-geografische landschappen (Vol. 11, 1920, pp. 275–284).

[235] Cf. his inaugural address: Economische aardrijkskunde, *Tijdschr. Econ. Geogr.*, Vol. 11, 1920, pp. 411–420.

[236] Inleiding tot de volkenkunde van Nederlandsch-Indie, Haarlem, 1920.

[237] Modern Deep-Sea Research in the East Indian Archipelago, *Geogr. Journ.*, Vol. 57, 1921, pp. 95–121, with bathymetrical map, 1:10,000,000.

[238] C. Crandijk: Het werk der nederl. opnemingsvaartuigen in den Oost-Indischen Archipel, 1915–1920, *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 37, 1920, pp. 112–114, with map, 1 : 10,000,000. (One of a series of quinquennial summaries which have appeared in the *Tijdschr.* in 1904, 1910, 1915.)

[239] Geologische verkenningen in de oostlijke Molukken, *Verhand. Geol.-Mijnbouwk. Genoot. voor Nederland en Kolonien: Geol. Ser.*, Vol. 3, 1916, pp. 31–55; On the Tectonics of the Eastern Moluccas, *Proc. Royal Acad. Sci. Amsterdam*, Vol. 19, pp. 243–248, March, 1917.

tioned: in the field of human geography, a discussion of population centers in the Netherlands from the Roman period to 1920 by J. C. Ramaer,[240] two studies of the growth of a rural town into an industrial city,[241] and an illuminating discussion of East Friesland,[242] that northwesternmost corner of Germany, which is by its nature, history, and population so closely related to its Dutch counterpart; and, in the field of historical geography, the work of Dr. F. C. Wieder, known to us for his contribution[243] to I. N. Phelps Stokes's "The Iconography of Manhattan Island," on the Dutch aspect of the early exploration and cartography of Spitsbergen.[244] Among institutions that promote interchange of ideas, reference may also be made to the Geographische Kring,[245] or circle of geographers, and the geographical excursions,[246] the thirteenth of which was held in July, 1921, under the direction of Professor J. van Baren of the geological department of the Agricultural College of Wageningen.

Switzerland

The universities of Switzerland of course reflect the essential bi-lingualism of the country. There are seven universities, but although the French-speaking inhabitants number about 20 per cent and the Germans 70 per cent of the whole population, each nationality may be said to maintain three and a half universities (Fribourg is bilingual). At all geography is represented. Each group draws its inspiration from, and belongs to the school of thought of, the country whose language it speaks. At the University of Fribourg Professor Paul Girardin, a pupil of Vidal de la Blache, in addition to doing physiographic work has written an excellent account of Fribourg as a study in city geography.[247] Like Luxemburg, in the principality of that name, which also deserves monographic treatment, Fribourg, with an upper town on the plateau top and a lower town in the valley bottom of the entrenched meanders of the river on which it lies, lends itself admirably to such a discussion. At the University of Lausanne Professor C. Biermann likewise does distinctive work in city geography, having written an excellent study of Lausanne[248] and its hinterland,[249] besides discussing Swiss cities

[240] De middelpunten van bewoning in Nederland voorheen en thans, *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 38, 1921, pp. 1–38 and 174–215, with four maps showing status in 1795, 1840, 1880, and 1920.

[241] H. Blink: Eindhoven als economisch centrum, *Tijdschr. Econ. Geogr.*, Vol. 11, 1920, pp. 307–313; H. van Velthoven: De ligging en uitbreiding van Eindhoven, *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 38, 1921, pp. 397–399, with map, 1:20,000, showing growth since 1851.

[242] H. J. Moerman: Oostfriesland, *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 38, 1921, pp. 665–688.

[243] Cf. also his: Onderzoek naar de oudste kaarten van de omgeving van New York, *ibid.*, Vol. 35, 1918, pp. 235–260.

[244] F. C. Wieder: The Dutch Discovery and Mapping of Spitsbergen (1596–1829). Published by the Netherlands Ministry of Foreign Affairs and the Royal Dutch Geographical Society, Amsterdam, 1919.

[245] *Tijdschr. Kon. Nederl. Aardrijksk. Genoot.*, Vol. 36, 1919, pp. 217–219; Vol. 37, 1920, pp. 254–255; Vol. 38, 1921, pp. 313–314.

[246] Twelfth, *ibid.*, Vol. 36, 1919, pp. 551–558; Thirteenth, *ibid.*, Vol. 38, 1921, pp. 746–749.

[247] Fribourg et son site géographique: Étude de géographie urbaine, *Bull. Soc. Neuchâteloise de Géogr.*, Vol. 20, 1909–10, pp. 117–128.

[248] Situation et site de Lausanne: Études de géographie urbaine, *ibid.*, Vol. 25, 1916, pp. 122–149 (abstracted in *Geogr. Rev.*, Vol. 6, 1918, p. 285).

[249] Le Jorat, *ibid.*, Vol. 20, 1909–10, pp. 5–116.

in general.[250] He has also made a study of *transhumance* in Valais, the upper Rhone valley,[251] and of the geographical basis of civilizations.[252] Professor Maurice Lugeon, the well-known geologist of the Alps, is also a member of the faculty at Lausanne. His pupil, Professor Emile Argand of the University of Neuchâtel, has recently published a standard synthesis of our present knowledge of the structure of the Western Alps.[253] Swiss geography has sustained a great loss in the death of Professor Charles Knapp in August, 1921.[254] Professor Knapp occupied the chair of geography at the University of Neuchâtel. He was an indefatigable worker. He founded the Geographical Society of Neuchâtel and made its *Bulletin* a scientific force. He edited, with G. Michel, the series of maps entitled *Documents Cartographiques de Géographie Economique* in which many valuable maps appeared; likewise a monumental geographical dictionary of Switzerland.[255] At the University of Geneva physical geography is represented by Professor Emile Chaix; he is at present annually engaged in the study of the Swiss National Park in the Engadine, with his son Dr. André Chaix, who is instructor of geography at the university. Political geography is represented by Professor William Rosier.

At the University of Berne, where the department was created and organized by Professor Brückner, now of Vienna, Professor R. Zeller has recently replaced Dr. Hermann Walser, who died in 1919.[256] Among his contributions to local geography, which are characterized by much insight, may be mentioned a study of villages in the Swiss Foreland in the canton Berne.[257] He also wrote an explanation of the admirable wall map of Switzerland in 1 : 200,000 which was prepared under government auspices.[258] Dr. Fritz Nussbaum, instructor in geography at Berne, has worked in Swiss physiography[259] as well as human geography.[260] At the University of Basel Professor Hugo Hassinger, formerly of Vienna and editor of the recently discontinued Austrian journal, *Deutsche Rundschau für Geographie und Statistik*, occupies the chair of geography.[261] His work has dealt mainly with Austrian lands.[262] At the University of Zürich Dr. H. J. Wehrli is

[250] Géographie des villes suisses, *44e Annuaire Soc. Suisse de l'Enseignement Secondaire*, pp. 151–177.

[251] Le Valais, *Revue Alpine: Section Lyonnaise*, Vol. 14, 1908, pp. 261–285.

[252] Le cadre géographique des civilisations, *Atti del X Congr. Internaz. di Geogr. Roma 1913*, Rome, 1915, pp. 1047–1072.

[253] Sur l'arc des Alpes occidentales, *Eclogae Geologicae Helvetiae*, Vol. 14, No. 1, Lausanne, 1916.

[254] For biographical appreciations see *Bull. Soc. Neuchâteloise de Géogr.*, Vol. 30, 1921, pp. 5–12 (by C. Biermann), *Ann. de Géogr.*, Vol. 30, 1921, p. 466 (by C. Biermann), and *La Géogr.*, Vol. 36, 1921, pp. 435–436 (by P. Girardin).

[255] Dictionnaire géographique de la Suisse, 6 vols. and atlas, Neuchâtel, 1902–10 (there is also a German edition).

[256] For biographical notice see Rudolf Zeller: Hermann Walser, *Petermanns Mitt.*, Vol. 65, 1919, p. 65.

[257] Dörfer und Einzelhöfe zwischen Jura und Alpen, 46 pp., *Neujahrs-Blatt Lit. Gesell. Bern auf das Jahr 1901*, Berne, 1900.

[258] Die Schweiz: Ein Begleitwort zur eidgenössischen Schulwandkarte, 3rd edit., Berne, about 1907 (French translation by C. Biermann, Berne, 1909).

[259] Die Täler der Schweizeralpen: Eine geographische Studie, 116 pp., Berne, 1910.

[260] Die Volksdichte des Kantons Bern, nebst Bemerkungen über die Darstellung der Volksdichte in der Schweiz, *Mitt. Naturforschenden Gesell. Bern*, 1919.

[261] Cf. his inaugural address: Über einige Aufgaben geographischer Forschung und Lehre, *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 8, 1919, pp. 65–76, Vienna.

[262] E.g. Die mährische Pforte und ihre benachbarten Landschaften, 313 pp., map in 1 : 750,000, *Abhandl. Geogr. Gesell. Wien*, Vol. 11, No. 2, 1914; Bemerkungen über die Südostgrenze des deutschen Siedlungsgebietes, *Geogr. Zeitschr.*, Vol. 25, 1919, pp. 215–219.

professor of geography. He contributed the section on India and Farther India to Karl Andree's "Geographie des Welthandels."[263] Dr. A. de Quervain, known for his crossing of Greenland, is instructor in geography and meteorology. Mention should be made of Professor F. Becker, professor of cartography at the Zurich Polytechnic Institute, as representative of the Swiss school of cartography,[264] of whose plastic representation of relief by means of natural colors and shadows the firm of Kümmerly and Frey of Berne, publishers of the school wall map referred to above and many other maps, are possibly the best exponents. In the way of maps Switzerland has a valuable collection in the Musée Cartographique of Geneva, which contains, besides others, all the maps drawn for Elisée Reclus' "Nouvelle Géographie Universelle" by Charles Perron. An excellent relief model of Switzerland by Perron is in the foyer of the University of Geneva, and large-scale models of the Bernese Oberland and other mountain groups, as well as a series of maps illustrating the development of the cartography of the Alps, are in the Alpine Museum in Berne.[265]

Austria

Austria, like German Switzerland, forms part of the German-speaking world of thought. With the universities political barriers have not counted: Germany, German Switzerland, and Austria have been a unit and their professorships have been interchangeable. Among geographers who have crossed the boundaries are Professor Penck of Berlin, long at Vienna (1885–1906); Professor Brückner of Vienna, who built up the department at Berne (1888–1904) and then went for a short time to Halle (1904–06); Professor Philippson of Bonn, who was for a short time in Berne (1904–06); Professor Friederichsen of Königsberg, who succeeded Professor Philippson at Berne for two years (1907–09); Professor Gustav Braun of Greifswald, who during part of the war was serving in the German army while professor at the Swiss University of Basel; and, among recent appointees, Professor Hassinger of Basel, who went there from Vienna, and Professor Krebs, who went from Vienna to Würzburg and then to his present chair at Freiburg. This relation to the German world, possibly more intimate since the cessation of Austria's orientation toward southeastern Europe, should obviously be borne in mind in any consideration of science in Austria.

Austria now has three universities, Vienna, Graz, and Innsbruck. At all geography is represented. At Vienna there are two professorships, occupied by Professor Eduard Brückner, author of the theory of climatic periodicity which bears his name and, with Penck, investigator of the glacial epoch in

[263] Vorder- und Hinter-Indien, pp. 513–673 in "Karl Andrees Geographie des Welthandels," Vol. 2, Frankfort 1912.

[264] Some of the phases of its development, especially of topographic mapping, are sketched in F. Becker: Die schweizerische Kartographie im Jahre 1914 (Landesausstellung in Bern): Wesen und Aufgaben einer Landesaufnahme, 87 pp., *Schweiz. Zeitschr. für Artillerie und Genie*, Frauenfeld, 1915.

[265] Cf. R. Zeller: Ein Rundgang durch das Schweizerische Alpine Museum in Bern, 36 pp., 3rd edit., Berne 1913.

the Alps, and by Professor Eugen Oberhummer, who has specialized in historical geography. Professor Oberhummer is president and Professor Brückner is one of the vice-presidents of the Vienna Geographical Society, which, through its contact with academic circles, has maintained a high standard. In November, 1916, the Society celebrated its sixtieth anniversary. On this occasion Professor Brückner discussed the Society's activities and the progress of geography in Austria during the preceding ten years.[266] Among his recent publications is a paper, partly based on the observations made during the American Geographical Society's Transcontinental Excursion of 1912, on the Great Lakes and their commercial importance.[267] Professor Oberhummer published in 1917 a valuable work on the racial origin and historical development of the Turks,[268] and another on the peoples of the Balkan Peninsula.[269] Recently, for the fourth centenary of Magellan's circumnavigation he wrote a critical account of the voyage, with maps of the route of the fleet through the Strait of Magellan and the East Indian archipelago.[270] Geography is further represented at Vienna by Dr. Erwin Hanslik and Dr. Otto Lehmann. Dr. Hanslik is known for his studies, important as to geographic method, of the contact between Slav and Teutonic civilizations, one of which deals with the German city of Biala in Galicia.[271] Dr. Lehmann specializes in physiography. Among his recent papers are a study of the Plateau of Langres,[272] the margin of the Paris Basin overlooking the Saône depression, observations for which were made on Professor Davis' excursion in France early in 1912, and a discussion of river sources.[273] Among other members of the Vienna faculty whose work has geographical bearing may be mentioned the ethnographer Professor Michael Haberlandt, who has recently published a book on the peoples of Europe and the Orient,[274] and Dr. Hans Mžik, who contributes a definition of the Orient.[275]

At Graz the chair of geography is occupied by Professor Robert Sieger, joint editor with Professor Franz Heiderich, of the School of World Commerce of Vienna, of the excellent re-creation of Karl Andree's "Geographie des Welthandels," to the final fourth volume of which he has contributed

[266] Die k. k. Geogr. Gesellschaft und die Entwicklung der Geographie in Österreich in den letzten 10 Jahren. *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 60, 1917, pp. 9–28.

[267] Die Grossen Seen Nordamerikas und ihre Bedeutung für den Verkehr, *ibid.*, Vol. 61, 1918, pp. 361–406.

[268] Die Türken und das Osmanische Reich, 115 pp., Leipzig, 1917 (somewhat expanded from original publication in *Geogr. Zeitschr.*, Vol. 22, 1916, pp. 65–87, 612–632, Vol. 23, 1917, pp. 78 ff. and 133 ff.).

[269] Die Balkanvölker, *Vorträge des Vereins zur Verbreitung naturwiss. Kenntnisse in Wien*, Vol. 57, 1917, pp. 263–332.

[270] Ferdinand Magellan und die Bedeutung der ersten Erdumsegelung, *Mitt. Geogr. Gesell. Wien*, Vol. 64, 1921, pp. 18–48.

[271] Biala, eine deutsche Stadt in Galizien: Geographische Untersuchung des Stadtproblems, 264 pp., Vienna, 1909.

[272] "Das Plateau von Langres" und die Hochfläche mit der Festung Langres, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 58, 1915, pp. 431–452.

[273] Über Fluss- und Bachursprünge in den Rückenlandschaften des feucht-gemässigten Klimas, *ibid.*, Vol. 61, 1918, pp. 113–142.

[274] Die Völker Europas und des Orients, 273 pp., Leipzig, 1920.

[275] Was ist Orient? Eine Untersuchung auf dem Gebiete der politischen Geographie, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 61, 1918, pp. 191–208.

a summarizing section on the classification of the economic regions of the world.[276] Recent of his writings in political geography deal with the relation between a state and its territory,[277] the state as an economic organism,[278] the geographical basis of the former Austria-Hungary,[279] and the broader geographical aspects of the difference in gauge of railway systems over the world and their influence on economic conditions.[280] Professor Heiderich has recently written on economic geography in general[281] and on the economic geography of Austria-Hungary.[282]

At Innsbruck Professor Johann Sölch occupies the chair of geography as successor to Professor Franz von Wieser, the eminent historian of cartography, who, at 70, had recently reached the retiring age at Austrian universities. Dr. Richard Marek, director of the Academy of Commerce in Innsbruck is also connected with the university. Professor Sölch contributed two papers to Professor Hettner's series on the war areas,[283] one on Rumania and one on Transylvania, and has recently published a geographical account of a pre-Alpine hill district between Mur and Drave on the German-Slovene contact zone.[284] Dr. Marek wrote a series of articles on the economic geography of southeastern Europe and Asia Minor and the commercial relations of these regions with Central Europe.[285]

The death of Professor Julius von Hann,[286] the eminent climatologist, in October, 1921, is a world loss to science. Only at the beginning of the year, at the age 83, did he turn over to younger hands the editorship of the *Meteorologische Zeitschrift*, which he had guided for fifty-five years.

Austrian War Work in Geography

Like Germany, although on a smaller scale, Austria undertook the scientific investigation of the lands she occupied during the war. For the study of the portion of Russian Poland which was under Austrian administration—the section lying south of 51½° N., except for a strip along the

[276] Die wirtschaftsgeographische Einteilung der Erde, pp. 3–128 in Karl Andree's "Geographie des Welthandels," Vol. 4, Vienna, 1921.

[277] Staatsgebiet und Staatsgedanke, *Mitt. Geogr. Gesell. Wien*, Vol. 62, 1919, pp. 3–17.

[278] Die Nation als Wirtschaftskörper, in Festschrift Eduard Hahn zum 60. Geburtstag, Stuttgart, 1917.

[279] Die geographischen Grundlagen der österreichisch-ungarischen Monarchie und ihrer Aussenpolitik, *Geogr. Zeitschr.*, Vol. 21, 1915, pp. 1–22, 83–105, 121–131.

[280] Wegbahn und Spur, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 59, 1916, pp. 362–404, with map of the world in Eckert's projection, 1 : 90,000,000, showing gauges of railroad systems.

[281] Wirtschaftsgeographie, in Festschrift der k. k. Exportakademie, Vienna, 1917, abridged in *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 60, 1917, pp. 223–228.

[282] Die weltpolitische und weltwirtschaftliche Zukunft von Österreich-Ungarn, *ibid.*, Vol. 59, 1916, pp. 73–105 and 137–169; Die Grundlagen der Agrarwirtschaft Österreichs, *ibid.*, pp. 727–735.

[283] Der siebenbürgische Kriegsschauplatz, *Geogr. Zeitschr.*, Vol. 23, 1917, p. 257 ff.; Der rumänische Kriegsschauplatz, *ibid.*, p. 409 ff.

[284] Die Windischen Bühel, *Mitt. Geogr. Gesell. Wien*, Vol. 62, 1919, pp. 220–226 and 241–276.

[285] Südost-Europa und Vorder Asien: Wirtschaftsleben und Handelsbeziehungen besonders mit dem Deutschen Reiche und der österreichisch-ungarischen Monarchie, *Geogr. Zeitschr.*, Vol. 22, 1916, pp. 139–161 (the lands on the lower Danube), 441–458 (former European Turkey and Montenegro), 510–527 (Greece), Vol. 23, 1917, p. 365 ff. and 422 ff. (Asiatic Turkey).

[286] Obituaries in *Meteorol. Zeitschr.*, Vol. 38, 1921, pp. 321–327; *Geogr. Rev.* (by R. DeC. Ward), Vol. 12, 1922, p. 312; *Ann. de Géogr.* (by Angot), Vol. 31, 1922, pp. 79–81; *Ann. Hydrogr. und Marit. Meteorol.*, Vol. 11, 1921, pp. 337–338.

Silesian border—[287]a Study Commission was created late in 1916 and attached to the Military Government of Lublin.[288] Its program was mainly directed to detailed studies in the natural sciences, and it therefore did not produce any synthetic geography of the area in its jurisdiction. Indeed this area is covered in the Handbook of Poland by the German commission already referred to. But the main Austrian field of work was the western Balkan Peninsula, especially Serbia, Montenegro, and Albania. Of most of this region adequate topographic maps were lacking, and the Austrian army engineers undertook its survey.[289] Before the war ended sheets in 1 : 50,000 had been completed of northern Serbia, western Montenegro, and central Albania. On the basis of this mapping Dr. Ernst Nowack, sometime of the School of Mines at Leoben, Styria, carried out various geological reconnaissances in 1917–18. In addition to the geology[290] and geomorphology,[291] which he discussed elsewhere, he has described the geography[292] of this region for readers of the *Review*. In the summer of 1916 Dr. Kerner von Marilaun of the Geologische Reichsanstalt had visited the little-known North Albanian Alps.[293] Under the auspices of the Vienna Geographical Society and the Academy of Sciences a geographical and geological expedition was sent to Serbia. Professor Krebs, then of Vienna, the geographer of the expedition, was in the field on two occasions of about five weeks in 1916, mainly in northern Serbia and the Novibazar region. He wrote several reports,[294] mainly on economic geography. An ethnographic expedition under the auspices of the Ministry of Education and the Academy of Sciences was undertaken in 1916 by Dr. Arthur Haberlandt, instructor in ethnography at the University of Vienna, in southern Serbia, Albania, and Montenegro.[295] In the summer of 1917 a general informational trip was organized by the Army Press Bureau to the occupied Balkan lands. Professor Oberhummer was a member of the party that went to Montenegro and Albania and has given us a geographical account of that trip.[296]

A consequence of the war, of special interest to geographers, may here be noted. Quite a number of the scientific staff of the Military Geographical Institute of Vienna, the excellent survey office of Austria, including the

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[287] Cf. J. G. Rothaug: Verwaltungsgebiete Österreich-Ungarns und des Deutschen Reichs in Polen, *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 5, 1916, pp. 30–32, with map in 1 : 2,000,000.

[288] *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 6, 1917, p. 56.

[289] Hubert Ginzl: Aufgaben und Tätigkeit der Kriegsmappierung auf der Balkanhalbinsel, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 61, 1918, pp. 497–513, with index map, 1 : 1,450,000, and samples of topographic sheets.

[290] Die geologische Erschliessung Albaniens im Kriege, *ibid.*, Vol. 62, 1919, pp. 211–219; Die Grundzüge der Tektonik Mittelalbaniens, *Centralblatt für Mineralogie*, 1920.

[291] Morphogenetische Studien aus Albanien, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1920, pp. 81–117.

[292] A Contribution to the Geography of Albania, *Geogr. Rev.*, Vol. 11, 1921, pp. 503–540.

[293] Reiseeindrücke aus den nordalbanischen Alpen, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 61, 1918, pp. 65–74.

[294] Vorläufiger Bericht über den ersten Teil der geographisch-geologischen Studienreise nach Serbien, *ibid.*, Vol. 59, 1916, pp. 609–614; —über den zweiten Teil —, *ibid.*, pp. 673–678; Wirtschaftsgeographische Beobachtungen auf den beiden Studienreisen nach Serbien, *ibid.*, Vol. 60, 1917, pp. 161–216, with statistical tables by Dr. Hermann Leiter; Zur Verkehrsgeographie Rasciens [i.e. the former sanjak of Novibazar], *Petermanns Mitt.*, Vol. 63, 1917, pp. 265–269.

[295] Berichte über die ethnographischen Arbeiten im Rahmen der historisch-ethnographischen Balkanexpedition, *Mitt. k. k. Geogr. Gesell. Wien*, Vol. 59, 1916, pp. 736–742.

[296] Montenegro und Albanien unter österreichisch-ungarischer Verwaltung, *ibid.*, Vol. 61, 1918, pp. 313–346.

chief of the technical division, Artur von Hübl, have been engaged by the Brazilian government for two years to co-ordinate the existing survey organizations in that country and establish a single organization to undertake the uniform topographic mapping of Brazil.[297] The Austrian cartographers reached Rio de Janeiro in October, 1920.

Denmark

Geography in Denmark has suffered a serious loss by the death, in October, 1920, on his return from a trip to Canada and the United States, of Professor H. P. Steensby,[298] who occupied the chair of geography at the University of Copenhagen since 1911. An all-round modern geographer in all that that term implies, he had developed the geography department at Copenhagen, the only one in Denmark, to a high state of efficiency. Fortunately he has left us an outline of his views in a book entitled "Introduction to the Study of Geography at the University of Copenhagen,"[299] which would prove a valuable guide to the student of geography in any country. In it he discusses such topics as the method of geography and the solution of geographical problems and gives a history of the growth of the various branches of the science and an outline of the development of geography as a university subject. He concludes with a systematic survey of landforms and their modifying agencies, including a characterization of the humid, glacial, and arid cycles of erosion. With Professor Steensby's work on Eskimo culture geography[300] and on the early Norse voyages to America[301] readers of the *Review* are already familiar.

As successor to Professor Steensby Dr. Martin Vahl was appointed in August, 1921. Professor Vahl's work has been mainly in plant geography: he collaborated with Warming in the preparation of his well-known manual of ecology and some years ago investigated the question of life zones from the phytogeographical standpoint.[302] He has recently published a generalized map of the vegetation regions of South America based on climate.[303]

Of other recent results of geographical work in Denmark may be mentioned a comprehensive geographical handbook of Denmark[304] by numerous authors under the editorship of Daniel Bruun, historian of the early Norse

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[297] Einrichtung eines militärgeographischen Instituts in Brasilien durch österreichische Militärgeographen. *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 9, 1921, p. 16.

[298] See obituary notices in *Geografisk Tidskrift*, Vol. 25, 1919–20, pp. 262–263, and *Meddelelser om Grønland*, Vol. 37, pp. i–ii, 1921.

[299] Inledning til det geografiske Studium ved Københavns Universitet, 190 pp., Copenhagen, 1920.

[300] An Anthropogeographical Study of the Origin of the Eskimo Culture, *Meddelelser om Grønland*, Vol. 53, pp. 39–228, 1917 (cf. Clark Wissler in *Geogr. Rev.*, Vol. 9, 1920, pp. 125–138).

[301] Norsemen's Route from Greenland to Wineland, *Meddelelser om Grønland*, Vol. 56, pp. 149–202, 1917; also reprinted as separate book, 109 pp., Copenhagen, 1918.

[302] Zones et biochores géographiques, *Overysigt Kong. Danske Vidensk. Selsk. Forhdl.*, 1911, No. 5 (= pp. 269–317).

[303] Vegetationskort over Sydamerika, *Geografisk Tidskrift*, Vol. 25, 1919–20, pp. 197–204, with map in 1 : 60,000,000.

[304] Danmark: Land og Folk: Historisk-topografisk-statistisk Haandbog. Edited by Daniel Bruun with the collaboration of a number of specialists. 2 vols. (Vol. 1, 663 pp.; Vol. 2, 429 pp.), Copenhagen, 1919. (Professor Steensby's contribution, "Danmarks Natur," is noticed in the *Geogr. Rev.*, Vol. 12, 1922, p. 327.)

settlement in Greenland under Eric the Red;[305] a new edition of a German translation[306] of Warming's manual of ecology; and an anthropogeographical study of Farther India.[307] In the pre-eminently Norse field of Arctic geography, an invaluable summary of the geography of Greenland,[308] with atlas, has just appeared in the *Meddelelser om Grønland*, in commemoration of the bi-centenary of the landing of Hans Egede, the "apostle of Greenland," and Knud Rasmussen has given us a general account of the results of his Second Thule Expedition in 1916–18,[309] while outlining the plans for his fifth expedition.[310] Lauge Koch, geologist of the Rasmussen expeditions, in a recent paper[311] suggests structural continuity between the ancient Caledonian mountain system (Scotland and Norway) and western Spitsbergen, northern Greenland, and northeastern Ellesmere Island. The career of the veteran geographer of Iceland, Thorvald Thoroddsen, who died in September, 1921,[312] was closed with the publication of an account of his island home and its people,[313] a Danish version of the Icelandic original.

Norway

The foremost advances in geography in Norway center, of course, around the name of Nansen. In his scientific capacity Dr. Nansen is professor of oceanography at the University of Christiania. Among his recent publications are a paper and book on his cruise to Spitsbergen in 1912[314] from whose results he makes deductions as to the tidal wave in the North Polar Basin and the extension and shape of the basin, and a preliminary but fundamental study (with Professor Helland-Hansen of the Bergen Geophysical Institute) of the temperature variation in the North Atlantic Ocean and in the atmosphere as a basis for the investigation of the cause of climatological variations.[315]

[305] Erik den Røde og Nordbokolonierne i Grønland, Copenhagen, 1915 (reviewed in *Geogr. Rev.*, Vol. 5, 1918, p. 254.)

[306] Eugen Warming's Lehrbuch der ökologischen Pflanzengeographie, von E. Warming and P. Graebner, 2nd edition, Berlin, 1918.

[307] Johannes Reumert: Nogle Traek af Bagindiens Anthropogeografi, *Geografisk Tidskrift*, Vol. 26, 1921–22, pp. 89–98 and 120–124.

[308] Grønland i Tohundredaaret for Hans Egedes Landing. 2 vols. and atlas (*Meddelelser om Grønland*, Vols. 60 and 61 and atlas), Copenhagen, 1921. The text contains a 174-page general account of Greenland, followed by detailed accounts of the various districts. The atlas contains general maps in 1 : 10,000,000 and detailed in 1 : 1,000,000. An English edition of the work in 3 vols. is in preparation.

[309] Grønland langs Polhavet: Udforskningen af Grønland fra Melvillebugten til Kap Morris Jesup, Copenhagen, 1919. English edition: Greenland by the Polar Sea: The Story of the Thule Expedition from Melville Bay to Cape Morris Jesup, New York, no date [1922?], with map of new surveys in northern Greenland 1 : 2,500,000.

[310] Den V. Thule-Ekspedition: Den danske Ekspedition til arktisk Nordamerika under Ledelse af Knud Rasmussen, *Geografisk Tidskrift*, Vol. 26, 1921–22, pp. 57–60.

[311] Stratigraphy of Northwest Greenland, *Meddelelser fra Dansk Geol. Forening*, Vol. 5, No. 17, map p. 73 text p. 75.

[312] See obituary notices in *Geografisk Tidskrift*, Vol. 26, 1921–22, p. 100, and this number of the *Geogr. Rev.*

[313] Island: Land og Folk, translated from the 3rd edition of the Icelandic original, Copenhagen, 1919.

[314] Spitsbergen Waters: Oceanographic Observations during the Cruise of the "Veslemöy" to Spitsbergen in 1912, *Kristiania Videnskapsselskapets Skrifter: I, Mat.-Naturv. Klasse*, 1915, No. 2, 132 pp. (reviewed in *Geogr. Rev.*, Vol. 3, 1917, pp. 500–501); En ferd til Spitsbergen, Christiania, 1920.

[315] Temperatur-Schwankungen des Nordatlantischen Ozeans und in der Atmosphäre: Einleitende Studien über die Ursachen der klimatologischen Schwankungen, *ibid.*, 1916, No. 9, viii and 341 pp. Translated into English, with additions by the authors and by Dr. C. G. Abbot, the solar physicist, as *Smithsonian Misc. Colls.*, Vol. 70, No. 4, viii and 408 pp., 1920.

Geography at the university is further represented by two instructorships, one in physical geography, occupied by W. Werenskiold, known for his work on the physiography of Norway,[316] the other in political geography, held by A. Arstal. Professor H. Mohn, who was working up the meteorological results of Amundsen's Antarctic expedition,[317] as of his previous expeditions, died in 1916.[318] Amundsen himself spent the winter of 1921–22 in the United States, completing, with Dr. H. U. Sverdrup, at the Carnegie Institution of Washington, the preparation of the studies in terrestrial magnetism to be made on his proposed drift across the Polar Basin in the *Maud*. Of the first part of this trip he has recently published an account.[319] Among other publications of interest may be mentioned a map, in more detail than is usual, of Nicholas II Land and adjacent islands north of Cape Chelyuskin, Siberia;[320] a report on the surveys made in 1909–10 by Gunnar Isachsen in Spitsbergen;[321] an article on the Lapp reindeer herds in Norway and their seasonal migration partly within Norway and partly across the Norwegian-Swedish frontier;[322] a geographical study of Christiania by Dr. Hans Reusch,[323] director of the Geological Survey of Norway, and an important atlas of the economic geography of Norway.[324]

Sweden

Modern geography is in a high state of development in Sweden. A rapid advance has taken place in the last few years, for which an active group of younger men is in no small measure responsible. The older established centers, however, are active also. The Swedish Anthropological and Geographical Society of Stockholm in 1919 added to its valuable organ *Ymer*, in which articles of general interest appear in Swedish, a scientific quarterly of international scope called *Geografiska Annaler*, in which papers are published mainly in English, French, and German. Its maintenance is guaranteed for at least five years by a gift of 100,000 crowns which was made to the society for that purpose. In addition there are geographical associations, of a more professional type and centering around the staff of

[316] Cf. e.g. The Surface of Central Norway, Memorial Vol. Transcontinental Excursion of 1912 of the Amer. Geogr. Soc., New York, 1915, pp. 357–365.

[317] *Kristiania Videnskapsselskapets Skrifter: I, Mat.-Naturv. Klasse*, 1915, No. 5 (reviewed in *Geogr. Rev.*, Vol. 2, 1916, p. 484, and Vol. 6, 1918, pp. 524–525), and 1916, No. 3.

[318] See obituary notices in *Monthly Weather Rev.*, Vol. 44, 1916, p. 518, and *Norske Geogr. Selskabs Aarbok*, Vol. 26–27, 1914–16, pp. vi–ix.

[319] Nord-Ost Passagen, Copenhagen, 1921.

[320] *Norske Geogr. Selskabs Aarbok*, Vol. 26–27, 1914–16, opp. p. 28, mean scale, 1 : 4,000,000.

[321] Gunnar Isachsen: Travaux topographiques de l'Expédition Isachsen, 1909–10, *Kristiania Videnskapsselskapets Skrifter: I, Mat.-Naturv. Klasse*, 1915, No. 7, 63 pp., with map 1 : 200,000 (referred to on pp. 216–218 in Charles Rabot: The Norwegians in Spitsbergen, *Geogr. Rev.*, Vol. 8, 1919, pp. 209–226, an article which is brought down to date by M. Rabot's note in the *Geogr. Rev.*, Vol. 12, 1922, pp. 303–304).

[322] Kristian Nissen: Lapper og ren i Norge, *Norske Geogr. Selskabs Aarbok*, Vol. 26–27, 1914–16, pp. 45–110, with map, 1 : 2,000,000.

[323] Kristiania geografi, 52 pp., Christiania, 1913, with two maps in 1 : 30,000 and 1 : 10,000.

[324] Per Nissen: Ökonomisk-geografisk atlas over Norge med en oversigt over de kulturelle og ökonomiske forhold saerlig naeringsveiene. Utarbeidet med statsbidrag under medvirken av mange fagmaend. (Atlas of the economic geography of Norway with a survey of the cultural and economic relations especially to trade. Compiled with government support and with the collaboration of many specialists.) 66 pp. text and 48 pp. maps, Christiania, 1921.

the geographical departments, at the three university towns of Gothenburg, Upsala, and Lund. The association at Gothenburg issues a journal at irregular intervals;[325] the Geografiska Föreningen in Lund was founded in February, 1921.

At the University of Stockholm human geography is highly developed. It is there in the hands of Dr. Sten De Geer, son of Baron De Geer, the well-known geologist. Concentrating on the fundamental problem of population distribution, he studied the island of Gothland[326] and the cities of the Baltic Sea region[327] and then brought his work to culmination in an admirable atlas of the population distribution of Sweden,[328] in which the "dot" and "sphere" methods of representation[329] tried out in the previous investigations were effectively applied. Other publications of Dr. De Geer deal with suggested new administrative subdivisions of Scandinavia on a geographic basis[330] and the political geography of the New Europe.[331] At the School of Commerce in Stockholm Professor Gunnar Andersson, editor of the geographical society's publications and, until recently, its secretary-general, is professor of economic geography. In this field, to which he turned from his earlier work in plant geography, he has recently devoted his attention to Australia[332] and the food resources of the world.[333]

At the University of Lund geography is strongly represented. In the Faculty of Letters Professor Helge Nelson, devoting himself at first to intensive studies of the history of settlement in the mining district of central Sweden,[334] has recently published an excellent paper on the human regions of Sweden,[335] in which human agglomerations are the basis of subdivision, in recognition of the fact that they are outgrowths of the region in which they lie and expressions of its character. The paper is intended to

[325] *Meddelanden från Geografiska Föreningen i Göteborg*, No. 1, 1912; No. 2, 1917.

[326] Befolkningens fördelning på Gottland, *Ymer*, Vol. 28, 1908, pp. 240–253, with maps in 1 : 300,000 and 1 : 900,000.

[327] Storstäderna vid Östersjön, *ibid.*, Vol. 32, 1912, pp. 40–87, with plate of maps of Baltic cities in 1 : 100,000 showing built-up area generalized. Cf. also *idem*: Die Grossstädte an der Ostsee, *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1912, pp. 754–766.

[328] Karta över befolkningens fördelning i Sverige den 1 januari 1917. Atlas of 12 plates in 1 : 500,000 accompanied by separate explanatory text: Befolkningens fördelning i Sverige: Beskrivning till karta i skalan 1 : 500,000, 296 pp., Stockholm, 1919. (See note in *Geogr. Rev.*, Vol. 9, 1920, p. 360, and Dr. De Geer's own statement in the *Geogr. Rev.* referred to at the end of the next footnote.)

[329] On the method of representation see Per Stolpe: Till frågan om Gottlands befolkningsfördelning, *Ymer*, Vol. 28, 1908, pp. 413–419; reply by Sten De Geer, *ibid.*, pp. 451–452; Alfred Söderlund: Förslag till intensitetsbeteckning vid konstruktion av täthetskartor, *ibid.*, Vol. 35, 1915, pp. 267–272; G. A. Larsson: Intensitetsbeteckningar vid kartografisk framställning av befolkningsfördelningen i tätare bebyggda trakter, *ibid.*, pp. 351–364; Sten De Geer: A Map of the Distribution of Population in Sweden: Method of Preparation and General Results, *Geogr. Rev.*, Vol. 12, 1922, pp. 72–83.

[330] Sveriges landsdelar, *ibid.*, Vol. 38, 1918, pp. 24–48 (abstracted in *Geogr. Rev.*, Vol. 11, 1921, pp. 143–144).

[331] Europas statsgränser och statsområden efter världskriget, *ibid.*, Vol. 40, 1920, pp. 253–302, with map showing the foreign population elements within the countries of Europe as now constituted.

[332] Om sambandet mellan natur och kultur i Australien, *Ymer*, Vol. 34, 1914, pp. 293–330; Australien: Natur och kultur, Stockholm, 1915 (reviewed in *Geogr. Rev.*, Vol. 7, 1919, pp. 431–432).

[333] Vårt dagliga bröd: Näringsväxterna i världsproduktionen, Stockholm, 1916.

[334] Om kulturgeografien i skolan (examples: Öland and Västra Västmanlands bergslag), *Ymer*, Vol. 32, 1912, pp. 88–102; En bergslagsbygd, *ibid.*, Vol. 33, 1913, pp. 278–352.

[335] Geografiska studier över de svenska städernas och stadslika orternas läge, *Lunds Univ. Årsskrift*, N. S., Section I, Vol. 14, No. 13, 110 pp., 1918; Sveriges kulturgeografiska provinser: Ett bidrag till diskussionen om Sveriges landsdelar, *Ymer*, Vol. 38, 1918, pp. 341–354 (noticed, with map, in *Geogr. Rev.*, Vol. 11, 1921, pp. 144–145).

furnish the foundation for a later detailed study of Swedish cities. Professor Nelson was in the United States and in Canada last summer, studying settlement methods in the northern Great Plains area. Dr. John Frödin of the Faculty of Science has dealt with the glacial features[336] and the tree limit[337] in northern Lapland and, lately, with *transhumance* in an alpine grazing region in central Sweden near the Norwegian border.[338] In the past summer he was engaged in a phytogeographical expedition to Morocco.[339] Dr. Arnold Norlind of the Faculty of Letters has studied the question of climate in historic times, especially in northern and central Europe,[340] and, recently, Magellan's circumnavigation of 1521.[341]

At the University of Gothenburg the chair of geography is occupied by the well-known geographer, Professor Otto Nordenskjöld. He has recently published a concise and helpful history of the development of scientific geography during the nineteenth century[342] and has added to his previous regional geography[343] a general geography[344] of the Polar lands. Professor Nordenskjöld has recently returned from a trip to Chile and Peru.[345] Oceanography is represented by Dr. Hans Pettersson, who has recently been investigating the relationship between meteorological influences and internal movements in stratified coastal waters.[346]

At the University of Upsala physical geography predominates. Dr. H. W. Ahlmann, until 1921 at the University of Stockholm, is doing advanced work in physiography according to modern methods. In keeping with his earlier expressed conception of geomorphology,[347] and its application to lake shores,[348] he recently published an excellent physiographic study of Norway.[349] He followed this with a preliminary investigation of the geomorphology of southern Sweden,[350] where conditions are more obscure than in the neighboring Norwegian area, the study of which in a way served as preparation. Dr. Ahlmann has also successfully worked in economic

[336] Några iakttagelser rörande glaciationen i norra delen af Lule Lappmark, *Ymer*, Vol. 35, 1915, pp. 98–109.

[337] Studier över skogsgränserna i norra delen av Lule Lappmark, *Lunds Univ. Årsskrift*, N. S., Section II, Vol. 13, No. 2, 1916 (with German résumé).

[338] Fäbodbebyggelsen i Kall och Offerdal, *Geografiska Annaler*, Vol. 1, 1919, pp. 353–386.

[339] *Ymer*, Vol. 41, 1921, pp. 356–358.

[340] Till frågan om det historiska klimatet, särskilt i Nord- och Mellaneuropa, *ibid.*, Vol. 35, 1915, pp. 83–97.

[341] Fernão de Magalhães och den första världsomseglingen 1519–22: Till 400-årsminnet, *Ymer*, Vol. 41, 1921, pp. 1–24.

[342] Geografisk Forskning og geografiske Opdagelser i det nittende Aarhundrede (in series: The Nineteenth Century Described by Scandinavian Scientists, edited by Aage Friis), Copenhagen, 1920 (Swedish edition, Stockholm, 1921), reviewed in *Geogr. Rev.*, Vol. 12, 1922, p. 324.

[343] Polarvärlden och dess grannländer, Stockholm, 1907 (German edition, Leipzig, 1909; French edition Paris, 1913.)

[344] Polarnaturen (in series: Popular Scientific Lectures at the University of Gothenburg), Stockholm, 1918, reviewed in *Geogr. Rev.*, Vol. 12, 1922, p. 324.

[345] En resa i Sydamerikas Kordillerastater, *Ymer*, Vol. 41, 1921, pp. 227–253.

[346] Papers in *Meddel. Geogr. Fören. i Göteborg*, No. 2, 1917, pp. 29–44, and *Geografiska Annaler*, Vol. 2, 1920, pp. 33–66, and Vol. 3, 1921, pp. 165–182.

[347] Geomorfologin som modern vetenskap, *Ymer*, Vol. 35, 1915, pp. 67–82.

[348] Strandzonens allmänna morfologiska utveckling med särskild hänsyn till insjöar, *Ymer*, Vol. 34, 1914, pp. 241–270.

[349] Geomorphological Studies in Norway, *Geografiska Annaler*, Vol. 1, 1919, pp. 1–148 and 193–252 (reviewed by W. M. Davis in *Geogr. Rev.*, Vol. 9, 1920, pp. 368–369).

[350] Some Working Hypotheses As Regards the Geomorphology of South Sweden, *Geografiska Annaler*, Vol. 2, 1920, pp. 131–145.

geography, recently producing a thoroughgoing study of northern Sweden.[351] The work done by the other members of the department of geography (Professor Axel Hamberg, head of the department, and Dr. F. Enquist) relates mainly to the glacial geology of Sweden. Professor Rudolf Kjellén of the political science department, however, makes contributions to human geography.[352]

Among other work of interest may be mentioned J. G. Andersson's investigations in China,[353] where he has been engaged since 1914 as adviser to the Chinese Government in mining matters, and his association with the recently created Geological Survey of China;[354] Baron Gerard De Geer's work in glacial and post-glacial geochronology, in connection with which he visited the United States and Canada in 1920,[355] and his recently published studies on Spitsbergen;[356] and Professor Carl Skottsberg's expedition to the eastern Pacific islands.[357] Among noteworthy publications the first volumes published of Sven Hedin's elaborate work on Southern Tibet,[358] with a map of Central Asia and Tibet in 1 : 1,000,000, stands foremost.

Finland

In keeping with the general high cultural level of Finland, geography has long been in an advanced state of development in that country, and even greater progress may be expected as a result of the newly acquired political independence. For over thirty years—since 1888—two geographical societies have existed in Helsingfors,[359] the Sällskapet för Finlands Geografi (Société de Géographie de Finlande) and the Geografiska Föreningen i Finland (Société Finlandaise de Géographie). The former, devoting itself almost exclusively to the geography of Finland, has since 1889 issued a valuable journal, *Fennia*, in which its researches are published, with sum-

[351] The Economical Geography of Swedish Norrland, *Geografiska Annaler*, Vol. 3, 1921, pp. 97–164 (abstracted in the *Geogr. Rev.*, Vol. 12, 1922, pp. 132–133).

[352] Inledning till Sveriges geografi, Gothenburg; Die Grossmächte der Gegenwart, Leipzig, about 1915 (German translation; post-war adaptation as: Die Grossmächte und die Weltkrise, Leipzig, 1920).

[353] Professor J. G. Andersson's forskningar i Kina, *Ymer*, Vol. 39, 1919, pp. 157–173 (see also notice in *Geografiska Annaler*, Vol. 1, 1919, pp. 387–388).

[354] J. G. Andersson: The National Geological Survey of China, *Geografiska Annaler*, Vol. 3, 1921, pp. 305–310.

[355] See note in *Geogr. Rev.*, Vol. 11, 1921, p. 139.

[356] On the Physiographical Evolution of Spitsbergen, Explaining the Present Attitude of the Coal-Horizons, *Geografiska Annaler*, Vol. 1, 1919, pp. 161–192, with map, 1 : 500,000 (reviewed in *Geogr. Rev.*, Vol. 8, 1919, pp. 283–285); Om Spetsbergens natur i Sveagruvans omnejd, *Ymer*, Vol. 39, 1919, pp. 240–277, with map, 1 : 100,000.

[357] Till Robinson-ön och världens ända, Stockholm, 1918 (reviewed in *Geogr. Rev.*, Vol. 12, 1922, pp. 324–325). See also *idem*: The Islands of Juan Fernandez, *Geogr. Rev.*, Vol. 5, 1918, pp. 362–383.

[358] Southern Tibet: Discoveries in Former Times Compared With My Own Researches in 1906–1908, 9 vols. (Vols. 1, 2, 3, 5 so far published, Stockholm, 1916–17), atlas of Tibetan panoramas (Stockholm, 1917), and separate maps: route surveys, 1906–08, 26 sheets in 1 : 300,000 (12 published, 1917); 40 sheets in 1 : 200,000; map of Central Asia and Tibet, 1 : 1,000,000 in 15 sheets (two published, 1917). (See a discussion of the historico-geographical, cartographical, and geomorphological phases of the work in *Ymer*, Vol. 38, 1918, pp. 101–186, and review in *Geogr. Rev.*, Vol. 10, 1920, pp. 424–425).

[359] Cf. e.g. Exposé des travaux géographiques executés en Finlande jusqu'en 1895: Communication faite au 6ème Congrès International de Géographie à Londres, 1895, par la Société de Géographie de Finlande, Helsingfors, 1895, pp. 7–8.

maries in German, French, or English. The latter has taken all of geography as its field and has published two journals, the one, since 1888, *Geografiska Föreningens Tidskrift* (called *Terra* since 1913), with articles of general interest in Swedish and Finnish only, and the other, since 1892, *Meddelanden af Geografiska Föreningen*, with major contributions in the two national languages but with German, French, or English résumés. In 1921 both societies were amalgamated,[360] retaining the name and journal of the former. It is not known whether the journals of the latter have ceased publication.

The work of the Geografiska Föreningen centers about the names R. Hult and J. E. Rosberg and is thereby closely associated with the development of geography at the University of Helsingfors.[361] About at the time of the founding of the two societies an instructorship in geography was established at the university and Dr. Hult was called to occupy it. He organized a department of geography in 1890 and through his work in the university became one of the leading contributors to the renascence of geography in Finland and to its recognition as a science. One aspect of Dr. Hult's work is familiar to American geographers because of the fact that Professor Ward has repeatedly called attention to his subdivision of the earth into climatic provinces.[362] Dr. Hult died in 1899. In 1902 the instructorship was raised to an associate professorship, and later to a full professorship, and Professor J. E. Rosberg, the present incumbent, was called to the chair. From that day to this[363] he has been an active worker in the improvement of geography in the schools, and was one of the chief memorialists of the petition to the government on that question.[364] In 1907 the position of director of seminar work in the department was created and Dr. J. G. Granö, well-known for his physiographic work in Mongolia and the Altai, the latest results of which have recently appeared,[365] was appointed. In 1908 an instructorship was established and Dr. I. Leiviskä, the present incumbent, appointed. He has recently published a comprehensive study, based on ten years' work, of the Salpausselkä,[366] the great terminal moraine which forms the southern border of the Finnish lake district.

At Åbo a university (Academy) with Swedish as the official language was opened in 1919, but only geology (H. G. Backlund), not geography is represented. Whether geography forms part of the curriculum of the

[360] Index Generalis: Annuaire général des universités, etc., 2nd issue, Paris, 1921, p. 1344.

[361] See L'enseignement de la géographie en Finlande: Exposé sommaire présenté par la Société Finlandaise de Géographie, *Meddel. Geogr. Fören. i Finland*, Vol. 8, 1907–09, 10th article, sections on the university, pp. 14–19, and on the Société Finlandaise de Géographie, pp. 19–21.

[362] Jordens klimatområden: Försök till en indelning of jordytan efter klimatiska grunder, *Meddel. Geogr. Fören. i Finland*, Vol. 1, 1892–93, pp. 140–201, with map of world in Mollweide's projection, 1 : 150,000,000. See Ward in *Bull. Amer. Geogr. Soc.*, Vol. 38, 1906, pp. 472–474, with Hult's map in Mercator's projection, equatorial scale, 1 : 97,000,000; and *ibid.*, Vol. 46, 1914, p. 110.

[363] Geografin och dess studium i Finland, särskilt Åbo, *Åbo Akad. Årsskrift*, 1918.

[364] Geografiska Föreningen inlaga till K. Senaten i geografi frågan, *Geogr. Fören. Tidskrift*, Vol. 18, 1906, pp. 161–166.

[365] Les formes du relief dans l'Altai russe et leur genèse: Étude morphologique, *Fennia*, Vol. 40, No. 2, 128 pp. (reviewed in the *Geogr. Rev.*, Vol. 11, 1921, pp. 155–156).

[366] Der Salpausselkä (in German), *Fennia*, Vol. 41, No. 3, 388 pp., 1920, with map 1 : 400,000.

Finnish-language university which was to be opened also at Åbo in 1921 is not known.

The Sällskapet för Finlands Geografi, not content with having produced an atlas of all phases of the geography of Finland (second edition, 1911), the like of which, for their national domain, only three or four countries in the world can boast, has, as one of the first scientific obligations of political independence, undertaken the preparation of a systematic geography of the country.[367] The work, which is in preparation by a number of specialists under the editorship of Dr. R. Witting, the Society's secretary, will consist of two volumes of about 700 pages each, the first dealing with nature and the second with man. The work will first appear in Swedish and Finnish, but an edition in one of the "world languages" is contemplated. Being causal in its geographical treatment it will not duplicate the handbook recently published under the auspices of the Ministry of Foreign Affairs.[368] A recent publication of the Society's on Finland's boundaries,[369] including those of the new outlet to the Arctic Ocean established by the Treaty of Dorpat of October 14, 1920, is of interest.

Of other interesting work may be mentioned that done in Finland to correlate with Baron De Geer's studies of the glacial and post-glacial time scale[370] and papers on the type landscapes and natural regions,[371] the phytogeographical boundaries[372] and the cities[373] of Finland, and a work on Eastern Carelia and Lapland.[374]

The Baltic States

Each of the three Baltic States has a university, Lithuania at Kovno (founded in 1920), Latvia at Riga (1919), and Esthonia at Dorpat (reorganized 1919). The records available do not show whether geography is part of the curriculum at Kovno or Riga. At Dorpat, the Finnish geographer, Dr. J. G. Granö, referred to above as director of seminar work in the department of geography at the University of Helsingfors, is listed as full professor of geography.

Poland

The new state of Poland has five universities: Warsaw, Cracow, Lwów (Lemberg), Lublin, and Poznań (Posen). Poznań and the Catholic University of Lublin are new foundations since the war. At all the universities except Lublin geography is represented. At Warsaw, according to recent

[367] Aperçu des actes de la Société d'octobre 1915 à mai 1918, *Fennia*, Vol. 40, No. 1, pp. 98–106, 1919; reference on pp. 105–106, detailed synopsis of contents in preceding report in Swedish, pp. 19–36.

[368] Finnland im Anfang des XX. Jahrhunderts, Helsingfors, 1919.

[369] Les frontières de Finlande, *Fennia*, Vol. 42, No. 10, 1921, with map 1 : 2,000,000.

[370] Matti Sauramo: Geochronologische Studien über die spätglaziale Zeit in Südfinnland, *Fennia*, Vol. 41 No. 1, 44 pp., 1918.

[371] J. E. Rosberg: Finska landskapstyper, *Fennia*, Vol. 40, No. 9, 25 pp., 1919.

[372] Om växtgeografiska gränslinjer i Finland, *Meddel. Geogr. Fören. i Finland*, Vol. 10, 1913–14, first article.

[373] J. Qvist: Die Städtebildung in Finnland und ihre geographischen Voraussetzungen, *ibid.*, seventh article.

[374] Theodor Homén, edit.: Ostkarelen och Kola Lappmark skildrade av finska natur- och språkforskare, Helsingfors, 1920 (English edition, London, 1921).

information,[875] there would seem to be two universities, the old university of Warsaw, and a recently founded Free University of Poland. At the former plant geography (B. Hryniewiecki) and meteorology (W. Gorczyński) are represented. At the latter there are professorships of physical geography and geography of Poland (S. Lencewicz), economic geography (J. Loth), meteorology (W. Smosarski), and ethnography (S. Poniatowski). At the University of Cracow the well-known physiographer, L. Sawicki, is professor of geography. At Poznań the chair of geography is occupied by S. Pawlowski, who recently published a geography of Poland.[876] Most of these instructors are contributors to the excellent first volume of the *Révue Polonaise de Géographie* (*Przeglad Geograficzny*) edited by Professor Sawicki and published by the recently (1917) founded Polish Geographical Society (Polskie Towarzystwo Geograficzne) in Warsaw. The review will only appear more or less irregularly at present, but each volume will be followed by a separate annual bibliography covering the geographical literature on Poland and geographic publications in Polish. An important predecessor of the Polish Geographical Society was the Polish Society for Geography (Polskie Towarzystwo Krajoznawcze),[877] which was founded in Warsaw about in 1906. In 1910 it began the publication of a weekly periodical called *Ziemia* (*Earth*), which, however, stopped at the beginning of the war. This society numbered 850 members in Warsaw by 1909 and several hundred more in the 21 sections it maintained in other parts of Poland. Since 1914 it has co-operated in the publication of the important series of *Physiographic Memoirs* (*Pamiętnik Fizyograficzny*) which have been appearing since 1881 and contain many important contributions to the geography of Poland.

Pre-eminent among Polish geographers is Professor Eugeniusz Romer of the University of Lwów, widely known for his studies of the human and political geography of Poland during the war and at the peace conference. His most important work is the admirable Atlas of Poland[878] (Warsaw, 1916; second edition, 1921), recently supplemented by an "Atlas des Problèmes Territoriaux de la Pologne" (Lwów, 1921), which reproduces many of the maps prepared for the Paris and Riga peace conferences, among the latter one in 1 : 1,050,000 (Pl. 39) showing the eastern boundary of Poland according to the Treaty of Riga, signed March 17, 1921. Under the editorship of Professor Romer a series of geographical memoirs is appearing (*Travaux Géographiques Publiés sous la direction de E. Romer*) of which some five numbers have been issued, dealing mainly with Polish problems of political geography. Associated with Professor Romer at Lwów are

[875] Index Generalis for 1921, pp. 454 and 456.

[876] Geografia Polski, Lwów, 1917. See also list of Pawlowski's papers in *La Géogr.*, Vol. 36, 1921, p. 107.

[877] M. Friederichsen: Die Polnische Gesellschaft für Landeskunde in Warschau: Aus Anlass ihres zehnjährigen Bestehens, *Petermanns Mitt.*, Vol. 62, 1916, pp. 459–460; *idem*, *Geogr. Jahrbuch*, Vol. 38, 1915–18, pp. 332–333; L. Sawicki: Landeskundliche Bestrebungen in Polen, *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 6, 1917, pp. 53–56 (this article contains a good general survey of the status of geography in Poland).

[878] Cf. review (by R. H. Lord) in *Geogr. Rev.*, Vol. 11, 1921, pp. 308–309; also *Ann. de Géogr.*, Vol. 29, 1920, pp. 382–384.

J. Czekanowski as professor of ethnology and H. Arctowski, well-known for his work on climatic changes and long resident in the United States, as professor of geophysics.[379]

Of great importance is a monumental Polish Encyclopedia undertaken by the Academy of Sciences in Cracow. Nineteen sections were contemplated, the first half of which are of geographical interest. Fortunately several of the first volumes have already been published:[380] Vol. 1 in 1912 on "The Physical Geography of the Polish Lands and Physical Characteristics of the Population" consisting of 16 articles by different contributors; Vols. 2 and 3 in 1915 on the Polish language and Vol. 4 on the beginnings of Slavonic civilization. Other sections were to deal with political history, historical geography, statistics, and economic conditions. Another work of this type, though originally intended for propaganda, is the Encyclopédie Polonaise published by the Comité National Polonais en Amérique.[381] Reference has already been made to the publications of the German geographical commission in Poland (p. 446).

Czechoslovakia

Since the establishment of Czechoslovakia as an independent state, two new universities have been founded, at Bratislava (Pressburg) and Brno (Brünn), but neither of them includes all the faculties as yet, and geography is not on the curriculum. At Prague, however, it is. Here, as before the war, there are two separate universities, the Czech and the German. At both geography is represented. At the Czech university there are two professorships of geography, occupied by V. Švambera, known for his work on the Congo, and J. V. Daneš, who has made a study of karst phenomena in various parts of the world, notably in Bosnia and Queensland. There are assistant professorships in meteorology and climatology (S. Hanzlík) and in economic and human geography (V. Dvorsky) and instructorships in geomorphology (V. Dědina) and ethnography (K. Chotek). At the German university the veteran African explorer Oskar Lenz is emeritus professor of geography, and Fritz Machatschek professor of geography. Dr. Machatschek, who is known for his physiographic work, has recently published in Penck's series of regional monographs the final results of his investigations in Turkestan,[382] to which the outbreak of the war abruptly put an end. Symptomatic of the change of conditions are the comparative pre-war and present budgets (in crowns) of the department of geography at the two universities, as follows: 1913 Czech, 1000; German, 1000; 1921: Czech, 6000; German, 1000.

[379] See his Agriculture and Landownership in Poland, *Geogr. Rev.*, Vol. 11, 1921, pp. 161–171.

[380] See *Ann. de Géogr. Bibliogr. Géogr. Annuelle* for 1913–14, No. 409, and H. Praesent: Bibliographischer Leitfaden für Polen, *Beitr. zur Polnischen Landeskunde*, Reihe B, No. 2, Berlin, 1917, pp. 4, 36–37, 38, 95–96.

[381] To embrace six volumes. Among the volumes of geographical interest already published are: Vol. 2 (Part I: Géographie et ethnographie; Part II: Démographie générale; Part III: Développement territorial), with atlas, Lausanne, 1920 (Part IV: Émigration et colonies polonaises à l'étranger, in press); Vol. 3 (Vie économique de la Pologne), with atlas, Lausanne, 1919.

[382] Landeskunde von Russisch-Turkestan (in series: Bibliothek länderkundlicher Handbücher, herausgegeben von A. Penck), 348 pp., Stuttgart, 1921.

Another factor in the development of geography in Czechoslovakia is the flourishing Czech Geographical Society at Prague, founded in 1895, which since its establishment has been publishing a valuable periodical (*Sborník České Společnosti Zeměvědné*) containing articles on Bohemia and systematic lists of geographical publications in Czech. Intellectual contact with France is maintained by the Institut Français de Prague, at which Professor Alfred Fichelle gives courses, mainly on the geography of France.[383]

Hungary

Since the war Hungary is reduced to two universities, the ancient University of Budapest and the newly founded (1914) University of Debreczen. At Budapest in addition there was established in 1919 a "Faculty of Political Economy." In 1907 a university had been created at Pozsony, but when this city became part of Czechoslovakia, the Hungarian university was withdrawn. A Czechoslovak university was established under the new name of the city, Bratislava, but, as stated above, geography is not represented in its curriculum. The faculties at Pozsony, likewise at Kolozsvár, now become Rumanian (see the section below), were transferred intact to Budapest. At all the Hungarian institutions referred to—Budapest, university as well as Faculty of Political Economy; Debreczen; Pozsony; Kolozsvár—geography is represented. The continued existence, at Budapest, of the Universities of Pozsony and Kolozsvár—according to the Hungarian conception—would seem to be indicated by the issuance under date of 1921 of the valuable first number of a joint publication of the geographical institutes of those two universities and of the university of Budapest and the Faculty of Political Economy.[384]

At the University of Budapest the chair of geography, formerly occupied by Professor Géza Czirbusz, who has recently published the first three volumes of a four-volume treatise on human geography[385] and a paper on the historical development of Budapest,[386] seems at present unoccupied, but there are instructorships in branches of geography, among which may be mentioned that of Dr. Michael Haltenberger in regional physiography. Dr. Haltenberger pursued studies in the United States in 1913, mainly relating to Block Island, on which he published several papers,[387] both before and after his return to Hungary. While here, he also wrote an interesting paper on

[383] A reflection of his reciprocal function, the spreading of knowledge of Czechoslovakia in France, is his paper: Les débouchés maritimes de la Tchécoslovaquie, *Ann. de Géogr.*, Vol. 30, 1921, pp. 241–248.

[384] Francis Fodor: Conditions of Production in Hungary, *Hungarian Geogr. Essays (Joint Publ. of the Geogr. Insts. Univ. of Budapest, Fac. of Polit. Econ., Univ. of Kolozsvár, and Univ. of Pozsony) No. 1*, 10 pp., diagrs. and maps, Budapest, 1921.

[385] Human Geography: Part I, Influence of Landforms, 127 pp., Budapest, 1915; Part II, Anthropogeography, 104 pp., Budapest, 1917; Part III, Political Geography, 62 pp. Budapest, 1919 (all in Hungarian). Part IV will deal with historical geography. Cf. the reviews in *Petermanns Mitt.*, Vol. 63, 1917, p. 37, and Vol. 64, 1918, p. 235.

[386] Historisch-geographische Lage von Budapest, *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 7, 1918, pp. 81–86 with map, 1 : 100,000.

[387] Among them: A Study of the Cartographical Development of Block Island, R. I., 36 pp.; Physical Geography of Block Island, R. I., 43 pp.; both Hungarian Adriatic Assoc., Budapest, 1917.

primitive modes of transportation.[388] During the war he discussed Rumania.[389] On the Faculty of Political Economy geography is represented by the well-known geographer, Count Paul Teleki, who occupies the chair of economic geography. Count Teleki was head of the Hungarian commission of preparation for the peace conference and later first Minister of Foreign Affairs and then Premier of Hungary. Count Teleki was indefatigable in working out material bearing on the geography, especially the ethnography of Hungary for the peace conference. The following are some of the publications of which he was the author or editor: four series of maps of Hungary in 1 : 200,000[390] showing (1) nationality, (2) religious adherence, (3) ability or inability to speak Hungarian, (4) ability or inability to read and write, which because of their large scale and the consequent placing of the colored circles, of size proportional to the number of inhabitants, in the actual locations where people live, give an intimate picture of conditions; a general ethnographic map of Hungary[391] on which, by an ingenious method, the area shown as inhabited by each nationality is proportional to its numbers; and a paper[392] and a valuable atlas[393] on the economic geography of Hungary. Among relevant publications by others may here be mentioned an atlas[394] and a general survey[395] of Hungary, historical, ethnographic, and economic. Count Teleki revisited the United States in 1921, on which occasion he addressed the Institute of Politics at Williams College.

At the University of Debreczen Dr. R. Milleker, author of a treatise on vulcanism[396] and formerly joint editor of the international edition of the *Bulletin of the Hungarian Geographical Society*, is professor of geography. At Pozsony Dr. Gyula Prinz had been appointed to the chair of geography; he had from personal association studied the structure and ethnography of the Tian Shan.[397] At Kolozsvár the head of the department was the well-known geographer, Professor Jenö de Cholnoky, now president of the Hungarian Geographical Society. Among his numerous publications only one, a general paper on the Great Hungarian Lowland,[398] which reflects

[388] Primitive Carriers in Land Transportation, *Bull. Amer. Geogr. Soc.*, Vol. 47, 1915, pp. 729–745.

[389] Rumänien in politisch-geographischer Beleuchtung, *Kartogr. und Schulgeogr. Zeitschr.*, Vol. 6, 1917, pp. 138–142.

[390] Ethnographical Map of Hungary, 1 : 200,000, 53 sheets (8 not finished) in portfolio, Hungarian Geogr. Soc., Budapest, 1918. Similarly: The Communes of Hungary Showing (2) The Distribution of Religions; (3) The Persons Speaking Hungarian; (4) The Persons Able to Read and Write. Data on all maps are hand-colored.

[391] Paul Teleki: Ethnographical Map of Hungary Based on Density of Population, 4 pp. of text and map in 1 : 1,000,000, [Budapest, 1918].

[392] Paul Teleki: Short Notes on the Economical and Political Geography of Hungary, 15 pp. and 6 maps mainly in 1 : 4,000,000.

[393] Paul Teleki, A. de Edvi Illés, and A. Halász, edits.: The Economics of Hungary in Maps, 6th revised edition with 75 maps and 6 diagrams, Budapest, 1921. The various elements represented are shown for all of Hungary in its former as compared with its present extent on maps in 1 : 4,000,000.

[394] La Hongrie: Cartes et notions géographiques, historiques, ethnographiques, économiques, et intellectuelles, 48 pp., [Budapest, no date].

[395] Louis Lóczy, edit.: A Geographical, Economic, and Social Survey of Hungary, 122 pp., Budapest, 1919.

[396] A vulkanizmus teoriái, Szegedin, 1910.

[397] Reise in den südlichen Gebirgsketten des Tien-Schan zwischen Narin und Maral-Baschi, *Bull. Hungarian Geogr. Soc.: Internatl. Edit.*, Vol. 38, 1910, pp. 185–211; Ethnographische Beobachtungen im Tien-Schan, *A Magy. Nems. Múzeum Néprajzi Osztályának Értesitöje*, Vol. 9, No. 1–2, pp. 69–90, Budapest, about 1909.

[398] Die Oberflächengestalt des Alföld, *Bull. Hungarian Geogr. Soc.: Internatl. Edit.*, Vol. 38, 1910, pp. 275–297, with physiographic map, 1 : 1,200,000, showing natural limits of the Alföld.

his work as head of the Alföld Commission of the geographical society, can be mentioned. The head of one of the Society's other commissions, that on Lake Balaton and editor of its many-volume scientific results, the eminent geologist, Professor Lajos Lóczy, died in 1920.

Rumania

The war has practically made no interruption in the existing energetic development of geography in Rumania; indeed, this development has proceeded more rapidly since that time. In this growth the Royal Rumanian Geographical Society of Bukharest has been an important factor. The important influence exerted as a matter of course by the universities has been enhanced since their increase, after Rumania's territorial enlargement, from the former two, Bukharest and Jassy, to four by the addition of Cluj (Kolozsvár) and Cernăutsi (Czernowitz).

The university men active in this development have been trained both in Germany and in France. Professor Mehedintsi, head of the department of geography at the University of Bukharest, is a pupil of Ratzel, under whom he took his Doctor's degree in 1899 with a suggestive thesis[399] and to whose memorial volume he contributed an anthropogeographical paper on the Rumanian steppe.[400] To provide a medium of expression for the work done in his department he created in 1909 an annual publication entitled *Anuar de Geografie shi Antropogeografie*, which has at least appeared to 1915 and which is replete with valuable studies in the geography, more especially the human geography, of Rumania.[401] Professor N. Iorga, the well-known historian at the University of Bukharest and editor of the *Bulletin de l'Institut pour l'Etude de l'Europe Sud-Orientale*, also makes contributions to geography, mainly on Rumanian territorial development.[402]

At the University of Cluj, in the department formerly presided over by the well-known Hungarian geographer Professor Cholnoky, Dr. G. Vâlsan has recently been appointed professor of geography. Professor Vâlsan is a pupil of Professor De Martonne of Paris. His thesis,[403] published in 1915, is an important and extensive physiographic study of the Rumanian plain. Both before and after this work he has made important contributions, mainly physiographic, to modern geographical knowledge of Rumania.[404] Associated with Professor Vâlsan at Cluj is Professor V. Merutsiu, who directed the department alone before Professor Vâlsan came from Jassy.

[399] Kartographische Induktion, Diss. Univ. Leipzig, 1899.

[400] Die rumänische Steppe: Eine anthropogeographische Skizze, "Zu Friedrich Ratzels Gedächtnis," Leipzig, 1904, pp. 249–255.

[401] For list of contents of Vol. 1, 1909–10, and Vol. 2, 1910–11, see: *Ann. de Géogr. Bibliogr. Géogr. Annuelle*, 1911, p. 170; of Vol. 3, 1913, *Bul. Soc. Reg. Române de Geogr.*, Vol. 34, 1913, No. 1, pp. 233–234; of Vol. for 1914–15, *ibid.*, Vol. 36, 1915, pp. 773–774.

[402] Auf- und Niedergang des türkischen Herrschaftsgebietes in Europa, *Petermanns Mitt.*, Vol. 59, I, 1913, pp. 1–7, with 5 maps, 1 : 10,000,000; Die Entwicklung des rumänischen Staatswesens, *ibid.*, Vol. 61, 1915, pp. 260–263, with ethnographic map, 1 : 1,500,000, by Langhans.

[403] Câmpia Română, *Bul. Soc. Reg. Române de Geogr.*, Vol. 36, 1915, pp. 313–568, with French résumé.

[404] Asupra trecerii Dunărei prin Portile de Fier: Studie de geografie critică, *ibid.*, Vol. 37, 1916–18, pp. 133–152; Văile: Origina shi evolutsia lor, *ibid.*, pp. 333–353; La terre et le peuple roumains, *Rev. Gén. des Sciences*, Vol. 31, 1920, pp. 338–342.

Professor Merutsiu has written papers on the salt deposits of Rumania[405] and the Rumanians of Transylvania.[406] The work of the department at Cluj has recently been described by Professor Vâlsan[407] and by Professor De Martonne,[408] the latter having given courses there and conducted an excursion in Rumania during the summer of 1921.

At the University of Jassy Dr. M. D. David is interim professor of geography. He recently published a paper on the physiographic evolution of Moldavia between the Sereth and the Pruth.[409] Professor I. Simionescu, the geologist at that institution, does work of geographical bearing, recently publishing a series of views, with comment, of Rumanian landform types.[410] At the University of Czernowitz, where Supan taught in the early days of his career, geography is at present represented by Professor K. A. Penecke, who occupied the chair of geology under the Austrian régime and still gives courses in geology. Dr. I. Prelipcean is listed as director of the geographical institute, likewise of the mineralogical institute.

Among other men of modern training should be mentioned Dr. Alexander Dimitrescu, who unfortunately died in 1917 at the age of 36.[411] He finished his studies in Germany, acquiring the doctorate in 1911 at the University of Berlin with a thesis on the lower Danube.[412] At Berlin he became familiar with American physiographic methods during Professor Davis' visiting professorship at that university. In addition to papers which reflect this influence on his studies,[413] he wrote on Rumania as a transit land.[414]

Among war-problem publications of geographical interest may be mentioned a map in 1 : 1,000,000 showing the distribution of Rumanians,[415] a political, historical, and ethnographic atlas of Rumania,[416] several publications on the Dobrudja,[417] and a reprint of Premier Bratianu's presentation of Rumania's territorial claims at the peace conference.[418]

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[405] Sarea în pământul Românese, *Bul. Soc. Reg. Române de Geogr.*, Vol. 33, 1912, pp. 69–162.

[406] Românii între Tisa shi Carpatsi: Raporturi etnografice, *Riv. Shtiintsifică V. Adamachi*, Vol. 6, 1915, pp. 135–143, Jassy.

[407] *Bul. Soc. Reg. Române de Geogr.*, Vol. 38, 1919, pp. 329–331.

[408] E. de Martonne: Enseignement et excursions géographiques en Roumanie, *Ann. de Géogr.*, Vol. 31, 1922, pp. 64–66.

[409] O schitsa morfologică podishului Sarmatic din Moldova, *Bul. Soc. Reg. Române de Geogr.*, Vol. 39, 1920, pp. 331–381, with French résumé.

[410] Tipuri geografice din România, *ibid.*, Vol. 36, 1915, pp. 714–738, with 64 illustrations (first published in *Rev. Shtiintsifică V. Adamachi*, Jassy, Vols. 3, 4, and 5).

[411] For biographical note see *Bul. Soc. Reg. Române de Geogr.*, Vol. 37, 1916–18, pp. 678–679.

[412] Die untere Donau zwischen Turnul-Severin und Braila: Geomorphologische Probleme, Diss. Univ. Berlin, 1911.

[413] W. M. Davis in literatura geografică contimporană, *ibid.*, Vol. 34, 1913, No. 1, pp. 175–179; Asupra teraselor aluvionare, *ibid.*, No. 2, pp. 17–26 (in German as: Über die Bildung der Alluvialterrassen, *Geogr. Anzeiger*, Vol. 12, 1911, pp. 101–103).

[414] România în tranzitul sud-est European, *Bul. Soc. Reg. Române de Geogr.*, Vol. 33, 1912, pp. 48–68.

[415] S. Demetrescu et al. Carte ethnographique des régions habités par les Roumains et les colonies étrangères qui s'y trouvent, 1 : 1,000,000, Paris, 1919.

[416] N. P. Comnène: La terre roumaine à travers les âges: Atlas historique, politique et ethnographique, 20 maps in 1 : 4,150,000, Lausanne and Paris, 1919.

[417] N. P. Comnène: La Dobroges (Dobroudja): Essai historique, économique, ethnographique, et politique, 208 pp., with 10 maps, Lausanne and Paris, 1919; N. Iorga, G. Vâlsan, et al.: La Dobrogea roumaine: Études et documents, 176 pp., separate from *Bull. Inst. pour l'Étude de l'Europe Sud-orientale*, 1919 (for contents see *Bul. Soc. Reg. Române de Geogr.*, Vol. 37, 1916–18, pp. 630–631).

[418] România la conferintsa Păcii, *Bul. Soc. Reg. Române de Geogr.*, Vol. 39, 1920, pp. 223–237.

The Rumanian Geographical Society's activities have been guided by a body made up largely of men in government administration and of professional geographers. Dr. S. C. Hepites, one of the vice-presidents, was formerly director of the Rumanian Meteorological Office. Professor Mehedintsi is head of the Educational Section and Professor Vâlsan is on the Editorial Committee. There is also a Military Section, presided over by General Iannescu. It is at present devoting itself to the creation of a Cartographic Museum;[419] valuable collections have already been donated by the French and Italian war offices. Another undertaking contemplated by the Society is a bibliography of Rumanian geography.[420] The society is in a flourishing condition, its membership having increased from less than 400 in 1913 to 1500 in 1920. In 1914, on the death of King Carol I, its late president, it received a bequest of 300,000 lei.

Yugoslavia

In Yugoslavia universities with incomplete faculties have been created since the war at Lyublyana (Laibach), Subotica (Maria Theresiopel), and Skoplye. Geography is represented only at the existing universities of Belgrade and Zagreb (Agram). At Belgrade the subject has been raised to a high state of development by Professor Jovan Cvijić, well known for his work alike in physical and in human geography, recent illustrations of which are his critical elaboration of the cycle of erosion in a karst region[421] and his excellent book on the human geography of the Balkan Peninsula.[422] In 1910 through the instrumentality of Professor Cvijić the Serbian Geographical Society was founded. Since 1912 it has published a journal (*Glasnik Srpskog Geographskog Društva*) of which six numbers have appeared, the last two in 1921. The *Glasnik* is replete with papers of scientific value on all phases of the geography of the Balkan Peninsula. Associated with Professor Cvijić as professor of geography is B. Milojević. Climatology (P. Vujević) and ethnology (T. R. Djordjević and J. Erdeljanović) are also represented. Likewise with Serbia French geography had close ties in the person of the late Gaston Gravier, a pupil of Demangeon and lecturer at the University, whose death on the battlefield cuts short the career of one who promised to develop into the foremost Western authority on the geography of the Serbian lands.[423] At Zagreb geography is represented by a professorship (Milan Šenoa, who has specialized in oceanography and re-

[419] For detailed plan see Misiunea Muzeului Cartografic al Societătii Regale Române de Geografie, *Bul. Soc. Reg. Române de Geogr.*, Vol. 37, 1916–18, pp. 418–520.

[420] *Ibid.*, Vol. 36, 1915, pp. 859–860.

[421] Hydrographie souterraine et évolution morphologique du karst, *Recueil des Trav. de l'Inst. de Géogr. Alpine* (Grenoble), Vol. 6, 1918, pp. 375–426. Abstracted by E. M. Sanders: The Cycle of Erosion in a Karst Region (after Cvijić), *Geogr. Rev.*, Vol. 11, 1921, pp. 593–604.

[422] La péninsule balkanique: Géographie humaine, Paris, 1918. For advance chapters in English see *Geogr. Rev.*, Vol. 5, 1918, pp. 345–361 and 470–482, and abstract of section on natural regions, *ibid.*, Vol. 9, 1920, pp. 199–204.

[423] Cf. his "Les frontières historiques de la Serbie," Paris, 1919 ("ce livre faisait présager un maître") and "La Choumadia," *Ann. de Géogr.*, Vol. 30, 1921, pp. 271–287, 351–361. Biographical notices in *Ann. de Géogr.*, Vol. 23–24, 1914–15, pp. 454–458, and *Glasnik Srpskog Geogr. Društva*, No. 5, p. 313, 1921.

cently contributed a bibliography of the geography of Croatia and Slavonia)[424] and assistant professorships in mathematical and physical geography (A. Gavazzi) and meteorology and climatology (A. Gilić, A. Mohoravičić, the latter also director of the Institute of Meteorology and Geodynamics).

Bulgaria

Geography is well represented at Bulgaria's only university, the University of Sofia, by Professor A. Ishirkov, a pupil of Ratzel, assisted by J. Radev. Professor Ishirkov has been an active writer, and his works are known in Western Europe, as they are accessible in German and French. The substance of several of his earlier studies is contained in his main work, a two-volume geography of Bulgaria.[425] In addition two papers on the settlements and the ethnography of the Bulgarians are of interest.[426] Several recent publications on the Dobrudja were called forth by the peace conference.[427]

Greece

At the University of Athens, the only university in Greece, geography is not represented. Some geographic work has been done by D. Eginitis, professor of astronomy. He has written on the climate of Athens and Attica.[428] The only other modern geographical work presumably by a Greek which is known to the writer is a monograph on eastern Crete by Dr. Leonidas Chalikiopoulos[429] of Cairo, who took his degree under Richthofen.

Conclusion

Even a cursory examination of the geographical work being done in Europe cannot but impress one with its variety, breadth, and truly geographical spirit. To the professional geographer it is an inspiration, a confirmation of his faith. From it he can draw strength to rededicate himself to his task. Recent events have roused general interest in his subject and led to a more widespread appreciation of its value and mission. Contact with the thought of his fellow-workers abroad will help him keep properly equipped for the wider opportunities for service of the new time. For us in America this contact, to our good fortune, has constantly become closer, especially in the last ten or fifteen years. International excursions and congresses, exchange professorships, and co-operation in various enterprises

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[424] Geografska bibliographija za Hrvatsku i Slavoniju, *Glasnik Hrv. Prirod. Društva*, 1917.

[425] A. Ischirkoff: Bulgarien: Land und Leute (in series: Bulgarische Bibliothek), 2 vols., Leipzig, 1916–17.

[426] Die Bevölkerung in Bulgarien und ihre Siedelungsverhältnisse, *Petermanns Mitt.*, Vol. 57, II, 1911, pp. 117–122 and 179–185; Ethnographische Karte des Bulgarentums auf der Balkanhalbinsel im Jahre 1912, *ibid.*, Vol. 61, 1915, pp. 339–343, with map, 1 : 500,000, Pl. 44.

[427] A. Ichirkoff: Les Bulgares en Dobroudja: Aperçu historique et ethnographique, with map in 1 : 750,000, Berne, 1919; A. Ichirkov and others: La Dobroudja: Géographie, histoire, ethnographie, importance économique et politique, Sofia, 1918.

[428] To klima tes Hellados, 2 vols., Athens, 1908; Le climat de l'Attique, *Ann. de Géogr.*, Vol. 17, 1908, pp. 413–432.

[429] Sitia, die Osthalbinsel Kretas: Eine geographische Studie, *Veröffentl. des Inst. für Meereskunde Univ Berlin*, No. 4, 1903.

have cemented personal ties; European contributions to our journals and our increasing study of European publications, in which the language barrier has proven less formidable than it sometimes appeared, have aided the interchange of thought. It is to our own interest to foster this interchange and thereby add the stimulus of other points of view to that native genius which promises to make American geography of ever increasing value in the advancement of knowledge.

March, 1922

GEOGRAPHICAL RECORD

AMERICAN GEOGRAPHICAL SOCIETY

April Meeting and Elections to Fellowship. At the April meeting of the American Geographical Society held on the 25th of the month at the Engineering Societies' Building, 29 West Thirty-ninth Street, Mr. John W. Davis, late Ambassador to Great Britain, spoke on the history of the boundary between Canada and the United States. His address, which was entitled "The Unguarded Boundary," will be printed in the October number of the *Geographical Review*.

At the March and April meetings, President Greenough presiding, there were presented with the approval of the Council the names of 247 candidates who were duly elected as Fellows of the Society.

Award of the Charles P. Daly Medal to Sir Francis Younghusband. The Charles P. Daly Medal of the American Geographical Society for 1922 has been awarded to Lieutenant-Colonel Sir Francis Younghusband, President of the Royal Geographical Society. It has been forwarded through the Department of State for presentation at London by the American Ambassador. An account of the ceremony will be given in a later issue of the *Review*. The medal bears the inscription

> Lieutenant-Colonel Sir Francis Younghusband
> For explorations in northern India and
> Tibet and for geographical publications
> on Asiatic and African borders of the Empire

The American Geographical Society's Index to the Journal of Geography. Last January the *Journal of Geography* celebrated the twenty-fifth year of its foundation by the publication of an "anniversary number" containing articles on the history of geographical education in America in this period and the part played therein by the *Journal*. The Foreword is by Professor Davis, recognized leader in the movement that gave birth to the *Journal*. Professor Dodge, than whom through his long years of editorship no one has done more for the *Journal*, gives "A Glimpse of the Past." His successor, Professor Whitbeck, deals with "The Journal in the Field of Education," and Professor Brigham with "A Quarter Century in Geography" (see also his paper "Geographic Education in America," *Ann. Rept. Smithsonian Instn. for 1919*, Washington, 1921). Other phases of educational geography are discussed by Professors Goode, Fenneman, Jefferson, and Miller.

The aims and progress of the *Journal* have always been followed with a sympathetic interest by the American Geographical Society, and at a critical time in the history of the magazine publication was taken over by the Society (1919–1920). The *Journal* was then acting as official organ of the National Council of Geography Teachers, founded a short time previously. By 1920 this organization had advanced to the stage when it was deemed advisable to transfer the *Journal* to its auspices, and this was accordingly done with provision for substantial financial support from the Society until July 1, 1922. The Journal is now under the editorship of George J. Miller, Secretary of the National Council of Geography Teachers.

While the *Journal* was in the hands of the American Geographical Society it was planned to compile an index covering the entire series of volumes. This has now been completed and is published in co-operation with the National Council of Geography Teachers. The index extends over the 25-year period, 1897–1921, and includes the first five volumes which were published under the title "*Journal of School Geography*" and the two volumes of the *Bulletin of the American Bureau of Geography* (edited by Professor E. M. Lehnerts), which latter publication was merged with the former in 1902 under the present title. The index numbers some 150 pages and is prefaced by a historical and descriptive introduction. Examination of the index reveals the large body of valuable material contained in the volumes of the *Journal*. Started in a period of great enthusiasm for the "new" geography, the *Journal* has included among its contributors geographers of note at home and abroad and among its contributions

material of permanent value. Illustration may be taken from the first five volumes. These include articles by W. M. Davis on "Home Geography" (reprinted in the January, 1922, number of the *Journal*) and several physiographic subjects; by R. E. Dodge on "Life on the Colorado Plateaus" and several papers on the teaching of geography; by R. DeC. Ward, "Climatic Notes made During a Voyage Round South America" and "The Climate of the Philippines;" by E. C. Semple, "Influences of the Appalachian Barrier upon Colonial History" and "Indians of Southeastern Alaska in Relation to their Environment;" by A. P. Brigham, "The Eastern Gateway of the United States;" by Collier Cobb on "North Carolina" and L. C. Glenn on "South Carolina"; by J. F. Chamberlain on "Southern California" and C. F. Marbut on "Missouri"; by G. K. Gilbert on "Origin of the Physical Features of the United States;" by W. S. Monroe, "Geographic Instruction in Germany;" by Mark Jefferson on "Caesar and the Central Plateau of France;" by F. P. Gulliver on "Vienna as a Type City." Other contributors are C. W. Hayes, F. H. Newell, N. M. Fenneman, J. P. Goode, G. D. Hubbard, F. V. Emerson, and I. C. Russell. Of foreign geographers contributing to these first five volumes we have Douglas Freshfield, "The Exploration of the Alps;" Edward Heawood, "The Egyptian Sudan and its History;" A. J. Herbertson, "Geography of Scotland;" R. H. Mill, "The Development of Habitable Lands" (reprinted), and papers by L. W. Lyde, A. Silva White, and G. G. Chisholm.

A copy of the index will be sent upon request to Fellows of the Society and to institutions exchanging publications with the Society.

Joint Meeting of the Association of American Geographers and the American Geographical Society. The sixth joint meeting of the Association of American Geographers and the American Geographical Society was held at the home of the Society in New York on April 28–29. President Greenough of the Society called the meeting to order, and President Barrows of the Association presided. There was an informal dinner at the Belleclaire Hotel on Thursday evening, April 27, and a round table conference on "Methods and Problems in the Study of Land Utilization" on Friday evening, April 28. The conference was well attended. Among the guests were Secretary Wallace of the Department of Agriculture, Professor Gautier of the University of Algiers, Professor Brouwer of the Delft Polytechnic Institute, Holland, Mr. Mendenhall of the Land Classification Board of the U. S. Geological Survey, Messrs. Taylor and Baker of the Office of Farm Management, and Mr. Smith of the Forest Service. The conference ended with an appeal from Mr. Taylor for co-operation in solving land problems before the Department of Agriculture and the appointment of a committee of the Association with that purpose in view. The program of the meeting follows:

VILHJALMUR STEFANSSON: Colonizing the Lands Beyond the Treeline.
ALFRED H. BROOKS: The Future of Alaska.
H. N. WHITFORD: Present and Prospective Use of Tropical Lands and Tropical Forests as Illustrated by the Philippines.
OLIVER E. BAKER: The Problem of Land Utilization and Its Geographic Aspects.
CARL O. SAUER: The Problem of the Cut-Over Pine Lands of Michigan.
HUGH H. BENNETT: The Soils of the Southeastern States and Their Utilization.
ROUND TABLE CONFERENCE: Methods and Problems in the Study of Land Utilization.
E. F. GAUTIER: Native Life in French North Africa.
H. A. BROUWER: Physical Features of the Dutch East Indies.
C. W. BISHOP: Geographical Factors in the Early Culture Development of Japan.

Abstracts of all of the papers will be published in the next volume of the Annals of the Association, and several papers, notably those of Messrs. Gautier, Brouwer, Bishop, and Baker will be printed in the *Geographical Review*. Mr. Stefansson's paper dealt with problems already fully presented in the "Friendly Arctic" and in a later volume, to be issued in August, entitled "The Northward Course of Empire." Mr. Brooks' paper was illustrated by a series of maps giving the various distributional elements in the geography of Alaska.

Mr. Sauer's paper dealt chiefly with the political features of a local problem that in one way or another has vexed Michigan since the days of the great lumber barons. Mr. Whitford's paper, like those of Messrs. Baker and Bennett, was an excellent example of the geographic treatment of land use and soil problems in relation chiefly to agriculture. These three papers were also of interest as continuing the earlier work of Brewer, Hilgard, Whitney, Shaler, King, and others. The original quality of Marbut's geographical work on the Soil Survey, the recent work of Marbut and Shantz in Africa (to be published by the Society,

together with maps on the scale of 1:10,000,000, in color), of Jefferson in Argentina and of McBride in Mexico (to be issued as monographs in the Research Series of the Society) are other examples of the recognition of the importance of a study of land problems, including soils, in geographical work. It is important to emphasize the point of historical continuity in the development of the science of soil geography because of ill-founded and misleading assertions recently put forward respecting ignorance of the subject of soil geography among geographers and its representation in a college curriculum for the first time in 1921! The "new" in geography has become almost a fad, and we are apt to overlook the fact that the recognition of soils and of other land problems in the study of man is new only to those who have but newly "discovered" its importance. As a matter of fact we are but advancing a study first established in the United States by Hilgard before the Civil War ("Geology and Agriculture of the State of Mississippi," 1860) and given wide practical recognition in this country first in 1884 by Hilgard in "Cotton Production of the United States," a work which forms the fifth and sixth volumes of the final report upon the Tenth Census, and in later years, especially in the present century, by many others.

NORTH AMERICA

The Interior Forests of Alaska. A contribution to the much discussed subject of the future of Alaska's resources is made by John D. Guthrie in an article "Alaska's Interior Forests" in the April number of the *Journal of Forestry*. The interior forests present a problem quite different from that of the coast forests. The latter, included for the most part (90 per cent) as National Forests, are comparatively well known; they have played an important part in local development and have an undoubted future in export trade (see the note on Alaskan Forests in the *Geogr. Rev.*, Vol. 1, 1916, pp. 216–217). Knowledge of the interior forests is scant and incidental but sufficient for broad description and the formulation of a definite policy in regard to their exploitation and protection. These forests are entirely unlike those of the coast in size, density, and species of trees. They constitute a woodland type comparable to the forests of northern Maine and eastern Canada though inferior as to quality. It is estimated that they cover not less than 150,000,000 acres pertaining to the unreserved public domain and lying almost entirely within the basins of the Yukon and Kuskokwim Rivers. The most northerly limit of the forest in central Alaska stretches well beyond the Arctic circle—68° 50′. The average altitudinal limit of tree growth is 2,000 feet.

As a source of lumber the interior forests cannot compete with the coast, and, though the species are well suited to the production of pulp, transportation would be prohibitive. On the other hand it is urged that the forest resources are no more than sufficient for local needs should the mining and agricultural possibilities of the Alaskan interior be realized. Already in the region of Fairbanks there is a shortage of readily accessible timber for constructional purposes. This shortage is attributed in the main to fires, a particularly serious menace where an annual rainfall of less than 15 inches and summer days of 20 hours' sunlight render the forests highly inflammable. It is estimated that some 25,000,000 acres have been burned over already. Furthermore, reforestation is considered impracticable under the climatic conditions of the Alaskan interior.

A Superpower System for the Region between Boston and Washington. The signing of the armistice providentially delayed a rapidly approaching power famine in the northeast manufacturing district of the United States. That there is a problem of power shortage to be faced sooner or later in that district, however, as population and industry increase, is indicated by the rapidity with which the development of war industries absorbed the available power.

A survey of the resources and needs of the region has recently been made under the direction of W. S. Murray, and the report has been published as "A Power System for the Region between Boston and Washington," *U. S. Geol. Survey Professional Paper 123*.

The territory in which the survey was made—the "superpower zone"—lies between the thirty-ninth and the forty-fourth parallels of latitude and extends from the coast to approximately 150 miles inland, including parts of Maine, New Hampshire, Vermont, New York, Pennsylvania, Delaware, and Maryland and all of Massachusetts, Connecticut, Rhode Island, and New Jersey. One-fourth of the population of the United States is concentrated in this area, and in it are operated—mostly independently—315 electric utilities, 18 rail-

roads with 36,000 miles of single track, and 96,000 industrial plants. The zone has relatively small hydro-electric resources and maximum industrial power requirements. Close to it, however, lie some of the best coal fields of the country. The problem, then, is to conjoin the hydro-electric supply of energy with the steam-electric supply so as to produce a maximum of energy for a minimum investment of capital and a minimum operating expense and at the same time conserve the rapidly disappearing cheap fuels of the Appalachian coal fields. Figured on the basis of the increase in the use of power in the last ten years, the total energy required in the superpower zone for the year 1930 will be 31,000,000,000 kilowatt-hours, of which about 21 per cent can be supplied by water power. A co-ordinated system of generation and transmission is suggested, which, it is estimated, will be able to furnish this power at an annual saving of $239,000,000 over the present unco-ordinated system. The system recommended includes a plan for the generation of energy by steam at tidewater and on inland waters where there is a sufficient quantity of condensing water to be had, and also the utilization of all hydro-electric power that can be economically obtained from rivers within the zone or within transmission distance. The system is to be co-ordinated by 34 load centers for the distribution of the energy generated. The superpower system is urged not to supplant or even compete with the existing electric utilities but to co-ordinate and supplement them and thus to promote economy of generation and transportation.

Of interest in this connection are the new state power maps which are being published by the United States Geological Survey. These maps, on a scale of 1:500,000, show the location of power stations and transmission lines used in public service and the names of the public-utility companies. They are available for all of the New England states and also for New York, New Jersey, Maryland, Delaware, and the District of Columbia.

EUROPE

The Distribution of Cultivation in Sweden. The absolute dot method of representing geographical distribution employed so successfully by Sten De Geer in his population studies of Sweden ("A Map of the Distribution of Population in Sweden: Method of Preparation and General Results," *Geogr. Rev.*, January, 1922) has been applied to the agriculture of the country by C. J. Anrick in a map entitled "Area under Cultivation in Sweden." On the map (scale 1:1,000,000) each square kilometer of arable land is shown by a square of one millimeter side. The data are derived from the official statistics of Sweden 1913–1920. Accompanying the map is a well illustrated description of the method and results ("Beskrivning till karta över Sveriges åkerareal, with English Summary of the Contents," *Sveriges Geol. Under-sökning*, Ser. B a, No. 10, Stockholm, 1921).

The cultivated area of Sweden comprises 38,235 square kilometers of arable land and 480 square kilometers of gardening land. Of the area below the tree line 11 per cent is cultivated. In Götaland and Svealand (southern and central Sweden) the arable land amounts to 20 per cent. In some limited districts in southern Sweden more than 90 per cent lies under the plow. This highly varying intensity of cultivation is clearly shown in the map.

The extension and distribution of the arable land is largely determined by the natural conditions. In southern Sweden the climatic conditions are most favorable, and the number of the cultivable plants is greatest. The different kinds of soils and their distribution and the different topography are of fundamental importance. Of importance also are the historical development and the length of time an area has been cultivated. More than one-third of the cultivated land has been laid under the plow during the last fifty years.

When the last land ice disappeared from Sweden the lower parts of the country were submerged below sea level or were covered by lakes. In the late glacial seas and lakes clay, silt, and sand were deposited; and now these districts of sedimentation, after having been elevated, form the principal areas of agriculture. Of the land now cultivated 74 per cent lies below the late-glacial marine limit. Next to the sediments mentioned, till is the chief agricultural soil, though its value, of course, varies greatly according to its character. Peat soil also is of importance.

In Figure 14 and in Plate I the author gives a generalized map of the distribution of the arable land. In the plate he also depicts the extent of the cultivation of wheat, rye, oats, and barley.

E. ANTEVS

The Famine Belt of Russia. The original famine belt of Russia extends from the north end of the Caspian northward to central Russia and thence in a broad belt eastward beyond the Ural Mountains. In Figure 1, below, the famine belt has been drawn as represented in a report of the American Relief Administration by Professor A. C. Coolidge, published in April, 1922. Upon it have been drawn the boundaries of the rainfall belts, and they serve to show the transitional situation of these borderlands, where risk of crop failure and famine is inevitable in dry seasons. In the *Geographical Teacher* (Vol. 11, 1921, p. 141), Unstead has given the average rainfall and temperature of Samara over a long period in contrast to the conditions of 1921 as follows:

	Rain in millimeters			Temperature—Degrees C.		
	April	May	June	April	May	June
Average 1893–20 . .	27.0	38.8	46.9	6.4	16.2	23.7
In 1921	1.7	0.3	5.1	12.4	24.7	31.1

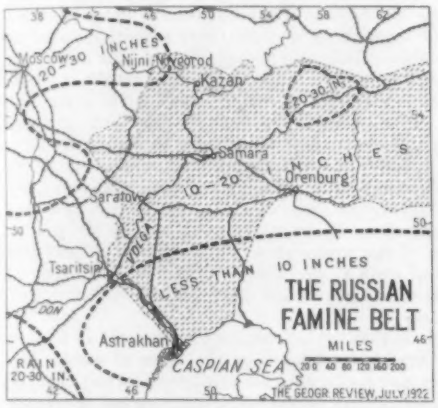

FIG. 1—Sketch map showing the famine area in Russia (shaded). Isohyets are added to show the "marginal" character of the Middle Volga basin, "naturally a rather poor grassland bordering an arid region."

It should be noted that though famine conditions first arose in the Samara region they have extended themselves over a wide district in the Ukraine, the Caucasus, and elsewhere. In the report of the American Relief Administration for May, Doctors Hutchinson and Golder report that: "In the eight or ten 'Governments' of Russia or the four 'Governments' of the Ukraine affected by famine, each one of which is comparable with the separate Transcaucasian republics in area and population, probably fifty per cent of the entire population is in serious want. In Georgia the percentage is not over two and one-half; in Azerbaijan, less than three and one-half; and even in Armenia, only twelve and one-half." They report further that contrary to the situation in Russia the lack of the Transcaucasian region is due to adverse political rather than climatic conditions, local wars interfering with ordinary agricultural pursuits. Armenia had deficient rainfall in 1921; Azerbaijan suffered from spring floods followed by hailstorms and a limited pest of locusts; and in Georgia early frosts in the fall of 1921 interfered to some degree with the autumn planting, and unusually heavy late spring rains prevented the proper ripening of the chief crop, maize. In spite of this, however, the average yield for the whole of Georgia was not far below normal. The chief difficulty in the relief of the Russians of the famine district is owing to congestion at the ports. It is impossible to evacuate food supplies as rapidly as they are received, and local congestion on the rail routes to the famine district further increases the delay. In continuation of this subject the reader is referred to the two following notes on agricultural conditions in eastern Europe and the historical geography of the Black Earth region.

Overpopulation in Relation to Agriculture and Famine in Eastern Europe. An exceptionally valuable analysis of the general agricultural conditions that underlie the state of famine now prevailing in eastern Europe is afforded by E. Dana Durand, former Director of the United States Census ("Agriculture in Eastern Europe," *Quart. Journ. of Economics*, February, 1922, Vol. 36, pp. 169–196). In his view the poverty of the masses is due "more to overpopulation than to any other one cause, if not more than to any of the other causes combined." Valuable comparisons are made between the density of population in the United States and those in Congress Poland, Galicia, and European Russia. It is shown that a far larger proportion of the population of eastern Europe is engaged in agriculture than is the case in the United States. Whereas, in 1920, 49 per cent of the population of the

United States was rural, in Congress Poland the figure was 68 per cent, in Galicia 80 per cent, and in European Russia 86 per cent. The number of rural inhabitants per square mile in the United States as a whole in 1920 was 17.3 (in Iowa, 27.4); in Congress Poland, 183; in Galicia, 213; in European Russia, 58; and in many sections of the country the rural density was from 100 to 150 per square mile.

Lacking industry to a high degree, eastern Europe with a very dense population must have a large part of its people work upon the soil. The result is a very minute division of the land to accommodate the individual farmer, and this division is enforced by scattered holdings absurdly small in size due partly to divided land inheritance generation after generation, partly owing to the subdivision and periodic redistribution of communal fields, and partly owing to the preference for land acquired by inheritance rather than land acquired by purchase because of a belief in greater security of title. Under these conditions a proper crop system cannot be maintained because the smallness of the holdings requires group action in sowing and harvesting crops. The alternative would require the individual to cultivate his tiny strip independently with tremendous loss of space and time. Farm animals are reduced in number to far below the level of efficiency, the low grade of living and the hopeless economic situation of the peasant conspire to foster primitive methods, and the consequence is that the average production of grain per acre is only little more than half as much in European Russia as in the United States, and the production per capita is far lower still. With his small holdings the peasant is required to consume the grain that he raises rather than to turn it into meat. Live stock is comparatively unimportant; there is a consequent lack of fertilizing manure; and the peasant is forced to be idle most of the winter, his productive efforts being confined for the most part to the crop season. The author wisely says that under these circumstances the export of grain represents an export from poverty and not from wealth of agricultural production. Its so-called surplus shown by export represents the contribution of agriculture to the state or to landlords in the form of taxes, rents, or profits of large estates. Even under these circumstances Poland had before the war hardly any net exportation of grain at all. Even in Rumania and Bulgaria, with less dense population, the greater part of the production of agriculture was consumed by the farming population itself.

The total effect of these circumstances was that agriculture was maintained in a state of delicate balance and that the peasant was almost always on the verge of want. The slightest accident might betray him. When war and revolution came with its reduction of agricultural output, its displacement of population in a region where industry had developed only in a limited way, disaster was bound to follow. Moreover, the city had nothing to give. The mining and manufacturing industries were more disturbed by the war than agriculture. The Soviet authorities followed the policy of requisitioning from the peasants their entire surplus and of suppressing entirely free trade of food. This was a blunder which had to be corrected. There was substituted a tax in kind, after which the producer was free to sell his grain. Added to these causes of disorganization was the lack of motive to produce. As a climax came the great drought in the Volga basin.

But if agriculture in eastern Europe has fallen, says Durand, it had not far to fall, and by the same token it has not far to rise again. By 1921 Poland, Rumania, and Yugo-Slavia were able to export food, though in small quantities, and there is promise of increase of efficiency in agriculture except in Russia. There, even if a stable government is soon established the recovery will take long because agricultural ruin has been more complete through the loss of machinery, tools, and draft animals, as well as the loss in confidence on the part of the peasant in any system of government. Added to these difficulties is the fundamental difficulty of the excessive density of the population which may affect all progress for decades and possibly for centuries. A large amount of labor exists but it is confined to small limits and is applied with a low grade of skill. Plowing methods are inadequate, and there is an improper rotation system and a wasteful practice of leaving land fallow every third year. Unless the people learn to restrict their numbers they may find it impossible ever to raise their standard of living, even with all of the large estates divided among them. Division of estates in itself will not solve the problem. The laborers on the estates must have their share. Some expense is necessary in equipping additional land, and though the large estates made up a large part of the total land area (in Poland 40 per cent) the large holdings include relatively small percentages of the total arable land (in Poland 25 per cent). The effect of the division of the land is to take away a source of irritation and to make possible a redistribution that will enable the peasant to consolidate his holdings

and make more effective the application of his labor. All this will necessarily involve the population in at least some confusion; and though the ultimate effect may be beneficial, the immediate effect is so small as hardly to bear at all upon the famine problem or the likelihood of its recurrence.

Steppe and Forest in the Settlement of Southern Russia. In connection with the present famine problem of Russia may be mentioned an extremely interesting paper read before Section E (geography) of the Edinburgh meeting of the British Association for the Advancement of Science (A. M. Gillett: A Sketch of the Historical Geography of the Black Earth

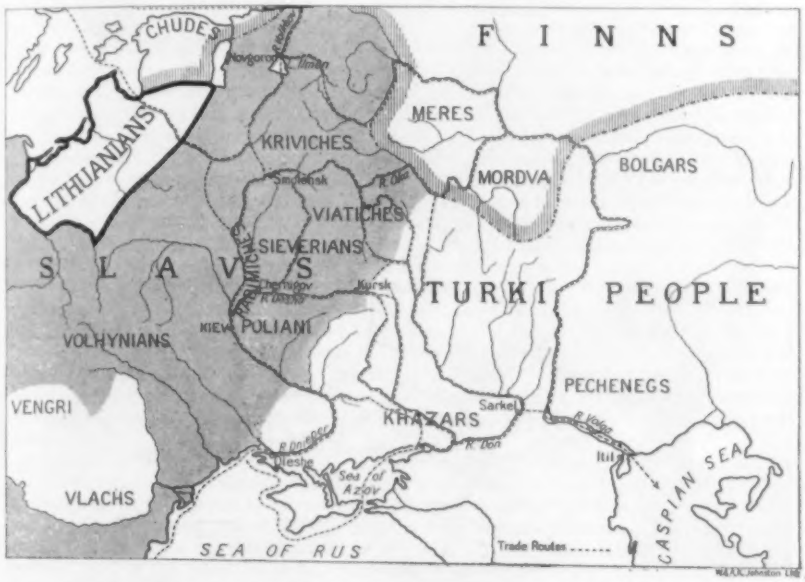

FIG. 1—Southern Russia in the ninth century, showing the peoples of Little Russia and the central Black Earth region. (Reproduced from the original drawing by the courtesy of the *Scottish Geographical Magazine*.)

Region of Central Russia, *Scottish Geogr. Mag.*, Vol. 38, 1922, pp. 1–10). The author considers as the pivotal fact of both early and later Russian history "that Russia is a plain open on the east by way of the Uralo-Caspian gate to the Asiatic influence which penetrated, almost entirely in the form of invasions of nomadic hordes, along the grassland route which led from the heart of Asia through southern Russia to the outposts of the steppe in Hungary." It was not altitude but vegetation that played the most important part. Asiatic nomads were confined to the southern steppe region; on the north they were limited by a belt in which the open steppe merged into forest. In this belt took place the struggle between the nomadism of the Tatar and the settled agricultural life that took root in the small clearings of the forest, where the Russian peasant had settled. The forest zone of northern Russia was occupied even in the centuries before Christ by a hunting and fishing people of long-headed Finnic stock, while the southern steppe zone was overrun by round-headed Asiatic invaders. The western neighbors of the Finns were Germans and Lithuanians; the Slavs were still concentrated on the eastern slopes and uplands of the Carpathians. The forest gave measurable protection to Slav and Finn alike, though the gradual advance of the Slav peoples caused a retirement of the Finns. The eastern Slavs were settled in the valleys of the middle and upper Dnieper "which from earliest times had served as the main north-to-south trade route across the western part of the Russian plain." Kiev as a trading town is located on the Dnieper at the point where the forests of the north merged gradually

into the southern steppe. The easternmost Slavs were a wild borderland people with the independent characteristics of frontiersmen. Their land was the battleground between the Slavs and the warlike steppe tribes, chiefly Tatar but with some Slav elements.

In the twelfth century the disruption of the Kiev community owing to social instability and nomad attacks developed two great streams of emigration: the one moved west to Galicia and Volhynia, which grew proportionately in importance; the other moved northeast toward the Oka and upper Volga, and the mixture of the latter stream of Russian colonization with the Finnish people resulted in the evolution of the Great Russian stock. Tatar invasions and supremacy from 1240 to 1480 delayed further colonization by both Great Rus-

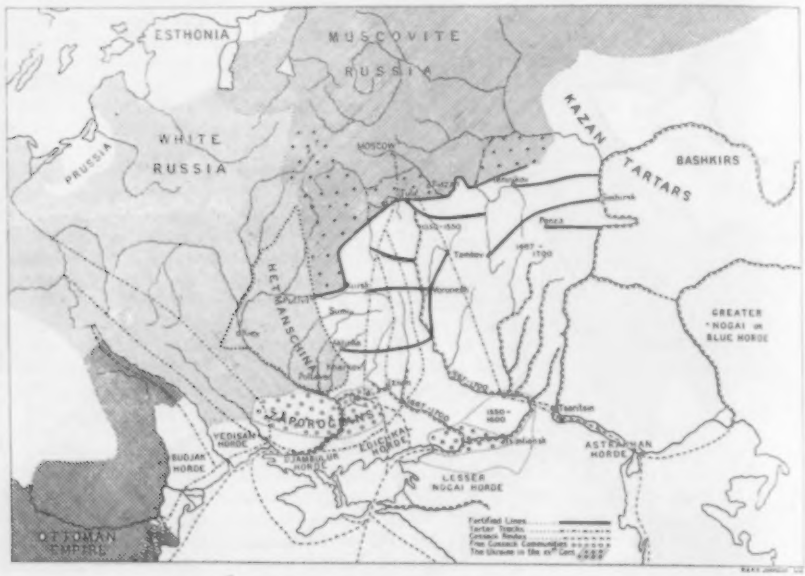

FIG. 2—Russia from the fifteenth century onwards, showing the advance of Great Russian colonization into the steppe. (Reproduced from the original drawing by courtesy of the *Scottish Geographical Magazine*.)

sians and Little Russians. When the Tatar yoke was thrown off in the fifteenth century there began a steady eastward territorial expansion preceded by Cossack outposts, which continued until the Russians stood at Port Arthur. Almost throughout the sixteenth century there was warfare on the southeastern frontier, where Tatar peoples continued to harass the Russian frontier. In the sixteenth and seventeenth centuries Great Russian colonization advanced behind the Cossack and a part of the scheme of defense was the construction of fortified lines designed to prevent Tatar penetration (Fig. 2). After the seventeenth century the Russian population increased in the steppe region by natural growth. In the eighteenth century all possibility of nomad raids was ended; Polish power declined. Cossack territory and Little Russia were included with the Moscovite Empire; the Don Cossacks were subdued. Settled life triumphed in the end. But, we may add, while it was a settled life it was still subject to catastrophes, like the present famine, that overtake the agriculturalist who makes his way beyond the border of the zone of safely habitable lands and takes his chances with the rain.

AFRICA

Boundary Settlement and Exploration in Wadai and Darfur. Wadai and Darfur have been two of the last of the African states to pass under European control. In all the Sudanese

countries the European has encountered a determined opposition that is in line with a development superior to that of other parts of tropical Africa. Infusion of Hamitic and Semitic blood in the negro races of the Sudan and the superior military and political organization gained through the adoption of Islamism encouraged here the growth of powerful states. Wadai under direct Senussi influence was in particular one of the most fanatical of Mohammedan states. In 1895 Keltie predicted that it would prove "one of the most difficult of all the African states to deal with," and the truth of his prediction was verified to the cost of France. Britain likewise owed her Sudanese troubles of the 80's to the Mahdi who started his disastrous career in Darfur.

It was after the defeat of the Mahdi's successor, the Kalifa, at Omdurman that France and Britain agreed upon the general disposition of the eastern Sudan (Convention of 1899): the Anglo-Egyptian Sudan was to include Darfur, Wadai to form part of French Equatorial Africa. Senussi influence soon provoked attacks on the French posts in Wadai, and the country was not pacified until 1912. It was during the military operations of 1909 that Lieutenant Boyd Alexander, the African explorer, was killed on the frontier. In Darfur quiet was maintained by a noncommittal policy, the while little confidence was placed in the Sultan, Ali Dinar, a caution justified by the events of 1915 when he threw in his allegiance with Turkey. "The difficulty lies not so much in fixing the frontier as in assuring respect for it when defined," wrote Frank R. Cana (Egyptian and Sudan Frontiers, *Contemporary Review*, May, 1914, pp. 688–797). The agreement of 1899 had definitively fixed the frontier south of 11° and north of 19° 30′. Between 11° and 15° the line was in principle that separating the kingdom of Wadai from the province of Darfur as it was in 1882, that is before the Khedive lost control of the Egyptian Sudan. But the ownership of the frontier country, especially the districts occupied by the Tama and the Masalit, was disputed by France and England. According to agreement of September 8, 1919, Dar Tama has been assigned to Wadai, Dar Masalit to Darfur (*L'Afrique Française*, Feb., 1920, pp. 55–57; *La Géographie*, Vol. 35, 1921, pp. 390–391). In the actual delimitation of the boundary on the ground it is provided that due regard be given to native rights—specifically in regard to water supply—and interests; and for the more northern portions the terms are elastic enough to meet the exigencies of an arid region occupied by scattered tribes whose customs and habitat are still very imperfectly known.

Settlement of the boundary question is a step towards realization of the possibilities of these lands which though semi-arid in the north are fertile in the south and offer great scope for agriculture proper as well as cattle breeding. Improvement of communications is another desideratum. El Fasher, the capital of Darfur, is 600 miles from Khartum, and the projected railway remains to be constructed for two-thirds of this distance; Abeshr is nearly as far from the forts of the Shari basin and exceedingly remote from any commercial center or market. Sir Philip Brocklehurst, who recently crossed Wadai from his frontier post in Darfur, describes the difficulties experienced by the French officials in obtaining stores at Abeshr ("Across Wadai," *Geogr. Journ.*, April, 1922). For the most part dependence has to be placed on Greek and Syrian merchants trading from Khartum. The road they travel—through Kordofan, Darfur to Abeshr—is now chiefly frequented by pilgrims making the journey to Mecca. In past times it figured as one of the great slave routes, the other being via the Kufara oases to Tripoli. With French occupation of Abeshr in 1909 the slave trade of which the capital had been the center ceased, and the town declined considerably. Another general cause of decline was the famine of 1914. The French authorities strongly urge construction of a railroad to link up the Sudanese countries. According to Sir Philip Brocklehurst the route along the pilgrim road from El Fasher through Wadai would offer little difficulty to such construction except in the mountainous portion of western Darfur. Here the line would run through a northern continuation of the Jebel Marra. Through Wadai the road runs through a generally level and scrub-covered country.

The Jebel Marra forms a part of the southeast-northwest trending watershed separating the Chad drainage from that to the Mediterranean, a belt of almost unknown highland regarding which our conjectures have been considerably modified as a result of Commandant Tilho's recent work in the Borku, Ennedi, and Tibesti regions north of Wadai (J. Tilho: The Exploration of Tibesti, Borkou, and Ennedi in 1912–1917, *Geogr. Journ.*, Vol. 56, 1920, pp. 81–99, 161–183, and 241–267). In particular he has shown that the mountains of Tibesti reach greater elevations—the highest peaks 10,700 and 11,200 feet—than was heretofore believed. Tilho, who continued his geodetic and topographic observations from these northern territories and established a liaison with the British work in Darfur, also ascribed a

much greater height to the unexplored summits of the Jebel Marra—9,000 to 9,800 feet instead of 6,000 feet. This mountain massif has more recently been penetrated by two British parties. In 1918 Captain H. F. C. Hobbs and Mr. J. A. Gillan ascended a peak in the southwest of the massif which altogether covers some 800 square miles and visited two lakes, the lakes of Deriba, previously known only by native report. The one lake, an object of superstitious awe to the natives, is regarded by them as an oracle. Ali Dinar is said to have sent messengers to consult it on the eve of his defeat by the British (H. F. C. Hobbs: Notes on Jebel Marra, Darfur, *Geogr. Journ.*, Vol. 52, 1918, pp. 357–363). In 1920 Captain H. Lynes and Mr. C. McConnel began a survey of the natural history of the massif, ascending from the same point as the previous expedition (*Sudan Notes and Records*, Vol. 4, 1921, pp. 119–137). They give altitudes for the massif on the order of those suggested by Commandant Tilho and much greater than are shown on Captain Hobbs' map. Thus the summit actually ascended was measured as 9,500 feet. This summit forms part of the rim of the great crater that constitutes the southwestern peak and rises at other points to still greater heights. The Deriba lakes lie within the crater—the salt lake on the floor of the main crater, the deep fresh-water lake within a more recent interior crater. Three biologic zones were recognized by Captain Lynes: the lower zone, up to 5,200 feet, characterized by vegetation of the thorny-prickly Sudan type; the upper zone, above 7,500 feet, which shows a marked change to temperate type; and between a sort of neutral zone. The lower slopes of the mountain are here barren and unpopulated, though the extent to which they are terraced indicates a formerly numerous population. The mountain people dwelling on the upper slopes are described as a shy, apathetic folk of low mental development. However, they live in well-built huts in fortified villages and are more advanced as cultivators than the people of the plains.

The Exploration of Mts. Kilimanjaro and Kenya. With the acquisition of the Tanganyika Territory (formerly German East Africa) the British have gained possession of Kilimanjaro, the highest mountain of Africa. Both of the great extinct volcanoes of East Africa, Kilimanjaro and Kenya, are now within the bounds of the British Empire. Kenya was ascended in 1899, and now Kilimanjaro has been successfully scaled by a British party. A brief account of the ascent made last October by four officials of the Tanganyika administration under the leadership of Mr. C. Gillman will be found in the *African World* for January 21, 1922, pp. 502–503, and in the *Geographical Journal* for May, 1922, Vol. 59, pp. 394–395.

The scientific exploration of Kilimanjaro, however, has been the work of the Germans. The first successful ascent was made in 1889 by Dr. Hans Meyer ("Der Kilimanjaro: Reisen und Studien," Berlin, 1900). Important investigations especially of the glacial features of Kibo, the main summit, were made by Dr. C. Uhlig in 1901 ("Vom Kilimandscharo zum Meru," *Zeitschr. Gesell. für Erdkunde zu Berlin*, 1904, pp. 627–650 and 692–718) and by Dr. Fritz Jaeger in 1904 (in company with Dr. Uhlig) and in 1906 ("Forschungen in den Hochregionen des Kilimandscharo," *Mitt. aus den Deutschen Schutzgebieten*, Vol. 21, 1909, pp. 114–146 and 161–197). More recently (1912) a party led and equipped by Eduard Oehler remained three months on the mountain carrying out topographic and scientific researches of the first importance. A photogrammetric survey was undertaken of the areas above an elevation of about 9,000 feet, and careful observations were made of the meteorology, geology, physical geography, and glaciers. A popular narrative of the expedition was given by Oehler in *Zeitschrift des Deutschen und Oesterreichischen Alpenvereins* (Vol. 46, 1915, pp. 124–156); the photogrammetric survey was described by Oehler's associate, Dr. Fritz Klute, in *Zeitschrift der Gesellschaft für Erdkunde zu Berlin* for 1921 (No. 3–4, pp. 144–151); and the scientific results of the expedition were discussed in an important monograph by Dr. Klute entitled *Ergebnisse der Forschungen am Kilimandscharo, 1912*, Berlin, 1920. The map on a scale of 1: 50,000 that was prepared from the photogrammetric survey accompany Dr. Klute's article and monograph.

The massif of Kilimanjaro, which covers an area of some 55 miles east and west by 35 miles north and south, was built by the action of three separate volcanoes along a line of structural weakness trending generally in an east-west direction. The slopes up to a height of between 11,500 and 14,500 feet coalesce and form one immense mountain mass culminating in the three cones of Shira (12,878 feet), Kibo (19,456 feet), and Mawensi (17,291 feet), the crests of which are separated by intervals of some ten miles. The crater form of Shira and Kibo, the western and central volcanic cones, may easily be recognized; but, owing to

the softer rocks which compose Mawensi, erosion by stream and ice has here progressed farther, producing a group of precipitous peaks.

From November to February Kilimanjaro is swept by the northeast monsoon: from March to October by the southeast trades. The summits of Kibo, Shira, and Mawensi rise well into the antitrades which here as elsewhere in this part of Africa blow from the northeast. The southeast trades are locally deflected so as to blow up the southern slopes of the mountain from the southwest. If Oehler's hypothesis is correct (it is accepted by Dr. Klute), this results from suction caused by the anti-trades passing through the gaps between Kibo and Shira and between Kibo and Mawensi.

The distribution and character of precipitation upon the mountain sides is determined in large measure by these winds, and in turn the details of surface morphology, glaciation, and vegetation cover depend upon the precipitation. In general it may be said that the highest parts of the mountain, like the steppes which surround it, are relatively arid. Maxima of precipitation are found at middle and lower altitudes, and in a belt of heavy precipitation which encircles the massif the greatest quantity of rain falls along the southerly and southwesterly slopes brought by the trades from the Indian Ocean.

Corresponding to the zone of greatest rainfall, a band of cultivated land encloses Kilimanjaro on all sides but the north, and at a higher elevation (6,200 to 11,800 feet on the south where widest) a girdle of primeval forest forms a complete circle. Dr. Klute believes that the lower border of the forest was determined by climatic conditions prevalent during a moister epoch. The forest once established, on account of its ability to retain moisture, has been able to maintain itself at a lower level than that at which it could establish itself under present conditions. Dr. Klute believes that the isolated patches of woodland now found in the cultivated area are remnants of a period when the forest extended even lower than it now does. Above the forest are grasslands, bushlands, and bare rocks; and on the summit of Kibo is an ice cap which sends out a row of small glaciers like fingers to the southwest.

The snow line is some 2,000 feet lower on the southern and southwestern sides of the cone than on the northern and eastern. The southerly side is not only less exposed to the dry anti-trades but is also open to moisture brought by the deflected southeast trades here blowing up the slope from the southwest. A study of the ice on Kibo led Dr. Klute to make some significant comparisons between the character of glaciation on volcanic cones like Kibo where the surfaces are convex and on mountains like the Alps that had reached a mature stage of dissection prior to the glacial period and where the surfaces are consequently concave. On the latter the snow and ice tend to converge into the valleys, here to accumulate to great depths forming cirques, and to flow off to much lower levels in long valley glaciers. On mountains of convex slopes the surface of the ice is greater in comparison with its volume, and the flow is divergent rather than convergent. Melting is accomplished more readily, and the lower limits to which the ice extends remain at a higher elevation even when climatic conditions are equal.

From a comparison of observations made by himself and others Dr. Klute asserts that the glaciers of Kilimanjaro have on the whole been receding during the past fifty to one hundred years but that this movement was interrupted during the first few years of the twentieth century when the ice front remained stationary. After 1906, however, recession was apparently resumed and, according to the reports of the English expedition of last October, has been in progress ever since (*Geogr. Journ.*, May, 1922, p. 395).

On Kilimanjaro, prior to the glacial period, well developed valleys had been excavated on Shira and on Mawensi. These became filled with ice during glacial times, and their upper extremities were converted into cirques. Cirques were also formed at elevations of 12,300 to 13,800 feet on the southern and southwestern exposures of Kibo, and a southwest-facing escarpment between Kibo and Shira shows that a series of semicircular glacial amphitheaters was occupied by small glaciers here, at approximately the same elevation.

From an examination of the terminal moraines of the glacial period Dr. Klute was able to trace successive stages in the withdrawal of the ice, but he could find no evidence of more than one distinct period of glaciation. The immense size of the cirques in comparison with the small stream valleys leading out of them seems to show that during the glacial period, as at the present day, the greater part of the run-off from melting ice was absorbed by evaporation. Glaciation then as now was developed on a vaster scale on the southern and southwestern sides of the mountain than on the opposite quarters. From this Dr. Klute concludes that the wind system of the glacial period must have been the same as that of the

present and that, if this be true, any shifting in the position of the poles or continents cannot be adduced as explanations of the incidence of the ice age.

From the human point of view Dr. Klute foresees an ever increasingly important rôle which the lowest slopes of Kilimanjaro are destined to play, despite their rain and clouds, as stations for sanitaria and refuges for convalescents from the more unhealthful coastal belt.

Kenya, lying approximately on the equator 210 miles to the north, still awaits thorough geographical investigation corresponding to that of Oehler and Klute on Kilimanjaro. In 1899 Mr. (now Sir Halford) Mackinder spent a month exploring the mountain and accomplished the first and only successful ascent of its highest point ("A Journey to the Summit of Mount Kenya, British East Africa," *Geogr. Journ.*, Vol. 15, 1900, pp. 453–486). During more recent years the Rev. Dr. J. W. Arthur has made five expeditions to the mountain but unfortunately has failed to reach the summit. The results of his explorations will prove of interest to both mountaineer and geographer (see J. W. Arthur: Mount Kenya, *Geogr. Journ.*, Vol. 58, 1921, pp. 8–25).

The height of Kilimanjaro—that is, of the highest point on the crater rim of Kibo called by the Germans "Kaiser Wilhelm-Spitze" and apparently not as yet rechristened by the British—was determined by Dr. Hans Meyer from barometric readings to be 6,010 meters (19,715 feet). This figure is probably somewhat excessive. The commission which surveyed the German-English boundary calculated the height by trigonometry to be only 5,890 meters (19,318 feet); and this is the figure which appears on the British General Staff map of 1915 (1:1,000,000). The Germans, however, claim that this represents the elevation of a point on the crater rim and not of the highest peak. Dr. Klute, from a combination of aneroid observations and from estimation, places the latter at 5,930 meters (19,456 feet), which is probably approximately correct (*Zeitschr. Gesell. für Erdkunde zu Berlin*, 1921, No. 3–4, pp. 148–149).

According to the British General Staff map of 1915 the height of Kenya is 5,195 meters (17,040 feet).

The Vegetation of Madagascar. The island of Madagascar is large enough and sufficiently varied in topography to afford conditions favorable for the development of many of the types of vegetation found on the adjacent continent of Africa. The prevailing southeasterly wind contributes to the maintenance of a luxuriant forest along the eastern slope of the island but since the watershed lies near the east shore there is a relatively small portion of the island, abundantly supplied with rainfall (see the relief map accompanying the article "Madagascar" by G. Grandidier, *Geogr. Rev.*, Vol. 10, 1920, pp. 197–222). On the northwest side of the watershed drought occurs following a rainy period sufficient to develop a good growth of grass. During the drought period this region is swept by fire, which not only prevents forests from invading the grassland but also pushes back the forests themselves where they come in contact with the grasslands. As on the African continent, a temperate rain forest extends along the top and down the east side of the watershed.

West of this forest region and extending around the south end and the north end as well is a region similar to the acacia-tall grass (low veld) areas of Africa where grasses predominate and where there are scattered trees. Fire destroys the grass almost every year and greatly limits tree growth. In the south and west the acacia-tall grass country gives way to a drier type similar to the thorn forest and acacia-desert grass areas of Africa. In the latter type fire is not a factor, since the growth of grasses is not sufficient to enable the fires to spread, and drought alone prevents the development of forests. Along the coasts there are mangrove swamps, and in the interior many marsh-grass areas.

Beginning in 1915 and continuing down to the present the Colonial Museum of Marseilles has published a notable series of botanical papers dealing with the French colonies. Of these, a number have dealt with the vegetation of the island of Madagascar. In a recent number Perrier de la Bâthie ("La végétation malgache," *Annales Musée Colonial de Marseille*, Ser. 3, Vol. 9, 1921) presents for the first time a concise picture of the vegetation of the island. The classification is unfortunately not based entirely on the vegetation itself. Division is first made into the original and the modified vegetation, and second, upon a climatic and physiographic basis the original vegetation is further divided into that found on the windward and that found on the lee side of the island. A map of the island shows the following types of vegetation: evergreen forest, deciduous forest, thorny brushland, mangrove, *savoka* (cut-over land), and prairie (burned-over grassland). On this map are

also drawn certain floristic lines separating different floral provinces, and two small maps give additional floristic data.

The original vegetation is now limited largely to the small area of forest which marks the east slopes of the watershed, forms a narrow strip in the south, but broadens out in the north and extends with many interruptions from coast to coast. Much of this original forest has been reduced to agricultural or cut-over land, and it now constitutes about 12 per cent of the area of the island. The brushland of the southwest is also regarded as of the original type, since here growth is not sufficient to enable fires to spread.

The greater part of the island—over fifty-one million hectares—is characterized by a modified vegetation which is classified under three main types, primarily according to botanical composition—the prairie, the *savoka*, and the mangrove. As a rule the number of species is small and a large proportion of the species are not endemic but are often world-wide in their distribution.

The prairie includes practically all the grasslands except the marshes, which are regarded as secondary. In this broad division are included both the luxuriant tall-grass prairies characterized by Andropogon and the desert-like short-grass lands characterized by Aristidas. These distinctions although not expressed on the map are of both economic and ecological significance.

The *savoka* is cut-over land which has partially reverted. Here are also included the early stages, represented by true ruderals which occur in cultivated fields or in fields recently abandoned, as well as the later stages in the succession leading to the re-establishment of the original forest.

The mangrove is also included in this section largely because it is characterized by a limited number of species. In fact the analysis here is based more largely on the botanical composition than upon the environmental conditions indicated by the plant types, and the grouping is therefore not well chosen to indicate crop potentiality.

The original vegetation is made up of a large number of species, many of which are endemic. This is divided on the basis of rainfall into the communities on the windward and leeward sides of the island respectively.

The vegetation of the windward side is divided into the eastern region,—a moist tropical region, the central region,—a region less moist and more temperate, and the region of Sambirano, warmer than the eastern region, but characterized largely by species from that region. The eastern region is characterized by high humidity and little change in weather during different seasons. In this region four formations are distinguished: (1) the littoral forest, largely developed on dunes and characterized by a low growth which produces construction timber, African ebony, and copal; (2) the marshes and lagoons; (3) the eastern forest, of complex botanical composition in which epiphytes are a prominent feature; (4) the mountain forests, constituting a type characteristic of exposed high mountains, where a large number of species occur and form a dense growth.

The forests of the eastern region are not readily destroyed by fire, but the greater amount of this forest has been cut and destroyed. Where reforestation takes place it passes through definite stages which must come in definite order and which require from 15 to 30 years to complete.

The central region comprises all areas above 800 meters and has a relatively temperate climate and less rainfall. Its limit is not well defined on the east but is relatively sharp on the west, where it is marked by the occurrence of deciduous trees. There are six formations in the central region: (1) the marshes, relatively abundant and characterized largely by sedges; (2) the dense forest, with herbaceous undergrowth, which lies between 800 and 2,000 meters elevation and represents a more temperate and somewhat less humid modification of the eastern forest; (3) the forest, characterized by an abundant lichen flora, which occurs only at high altitudes and is similar to the forests of the high mountains in the eastern part; (4) the ericaceous brushland, which also occurs at high altitudes where it represents the upper zone of vegetation on the island; (5) forests of the western slopes, relatively dry and very inflammable; (6) the rock xerophytes, where soil is denuded or thin and rock comes to or near the surface.

The formations of the central region are readily and rapidly destroyed by fire, and a few successive fires will reduce the forest to an Aristida prairie. In this destructive process the crests and ridges are first denuded, the other places retaining their original vegetation. In the next stage the forests occur only as small isolated clumps, and in the final stage the grassland replaces these isolated forests.

The remaining portion of the region on the windward side is discussed as the region of Sambirano. It is a small region on the northwestern side of the island where the forests of the east coast extend across to near the west coast. It differs from the remainder of the west coast in being much more humid and hotter. It contains forests of which three formations are distinguished, based on soil and topographic conditions as follows: (1) forests on alluvial land and at the edge of bodies of water; (2) forests on slopes and heavy soil; and (3) forests on sandy hills.

The vegetation of the lee side suffers prolonged drought periods. This part of the island is divided into western and southern regions. In the western region rainstorms and high temperature prevail for five months, followed by seven months of intense dryness. A large portion of this region occurs south of the region of Sambirano, and a small portion north which extends to the eastern shore some distance south of the north end of the island. In the western region six formations occur: (1) the raphia swamps, varying greatly in composition from pure Typha to palm swamps; (2) the alluvial forest, characterized by beautiful tall trees and little underbrush and distinguished from other formations of the western region by the abundance of lianas and by the persistent foliage; (3) the forests of the lateritic hills, consisting of small deciduous trees; (4) the forests of the calcareous plateau, characterized also by small or very large deciduous and thorny xerophytic tree growth in which Adansonia occurs; (5) the forests of the sandy hills, with xerophytic trees and bushes; (6) the xerophytic brushland, characterized by spiny and fleshy-stemmed plants such as Aloe, Euphorbia, etc.

The southern region is a xerophytic brushland, characterized by Didierea and other fleshy plants. Here fires cannot spread, and the vegetation can maintain itself against the encroachments of the prairie.

H. L. SHANTZ

ASIA

British Enterprise in Northern Baluchistan. From the days of Alexander of Macedon down to the last decade of the nineteenth century, the country bordering on the northern frontier of Baluchistan remained almost utterly unknown to Europeans. A barren district, much of it a true desert inhabited by predatory Baluch nomads, it lay far from the beaten tracks of commerce and of war. Only when British India began to fear Russian influence from the north was a concerted effort made to bring law and order into these regions.

Much of the success of British policy there is due to the work of Colonel Webb Ware, who in 1897 was placed in charge of the territory along the Afghan boundary by Mr. Hugh Barnes. Mr. Barnes, now Sir Hugh, had taken a prominent part in the survey of the boundary in the previous year and at the time was agent to the Governor General in Baluchistan. Under Colonel Webb Ware's management most of the native tribes, excepting the Sarhadi, were pacified; and a telegraph and caravan route was established from Quetta to Robat, near where the frontiers of Persia, Afghanistan, and British Baluchistan meet. Commercially this route offered an easy line of ingress for British trade to the markets of Khorasan. Strategically it strengthened the Indian frontier and offered a base from which military action might be taken against Afghanistan should the necessity arise. It also enabled the British to intercept the dangerous traffic in arms between the Persian Gulf and the Indian borderlands. So flourishing did the trading by camel over this route become, that in 1905 the government of India constructed a railway from Quetta to Nushki to obviate a difficult ascent of some 3,000 feet which the camels had to make on their journey eastward. Early in the World War German and Turkish aggression in Persia, together with a shortage of camels, induced the Indian government to extend the railway to a point halfway between Nushki and the Persian frontier, and its final completion to this frontier was determined upon immediately after the Russian debâcle in 1917 and completed in 1919.

The whole matter of the Nushki Railway with its historical and geographical setting was discussed by Colonel Webb Ware in a lecture which he delivered before the Central Asian Society (London) and which was followed by illuminating comment from Sir Hugh Barnes (*Journ. Central Asian Soc.*, Vol. 6, 1919, pp. 44–92).

The Sarhad is a wild, mountainous tract lying between Persia and Baluchistan. It has at all times been the haunt of lawless, intractable tribes. Not long after the opening of the

caravan route, Persian Baluchistan threw off all semblance of Persian authority, and raiders from the Sarhad carried terror and devastation throughout the greater part of eastern Persia. It is a testimonial to the order established in Baluchistan that, in spite of these raids, the trade route, "which lay within a single day's easy march of their tribal headquarters was never touched until the spasm of unrest which followed the opening of the war passed over the country in 1915." The story of the final subjugation of the Sarhad raiders in 1916 is graphically and informally related by Brigadier General R. E. H. Dyer in his book entitled "The Raiders of the Sarhad," London, 1921.

AUSTRALASIA AND OCEANIA

Some Recent Studies in the History of Australian Exploration. Though the main events in the history of Australian exploration have been recorded in easily available works, there still remain wide gaps in the record. Much attention has been devoted of late years by Australian geographers and historians to the filling in of these gaps, and the field is rapidly being prepared for the production of a history of far broader scope than any that has yet appeared.

Probably the best general introduction to published materials on Australian discovery and exploration will be found in those sections of the *Geographisches Jahrbuch* relating to Australia and to the history of geography from the close of the Middle Ages onward. These carry the student through the year 1908; but since that date investigation has been pushed forward vigorously, hitherto unpublished materials have been brought to light, reprints have been made from rare books, and many data previously uncorrelated have been gathered together in convenient form.

The whole question of the knowledge of Australia before the well authenticated Dutch voyages of the seventeenth century is highly treacherous and controversial ground upon which one must enter with caution. Some writers have even sought to associate ancient Greek speculations about vast southern lands with veritable knowledge of Australia, and an extremely dubious claim has been advanced in favor of the discovery of the western coast by the Frenchman, Paulmier de Gonneville, in 1503. There is a greater measure of probability in the supposition that the west coast may have been visited by the Portuguese and the eastern coast by the Spaniards in the sixteenth century (Ricardo Beltrán y Rózpide: Juan Fernández y el descubrimiento de la Australia, *Rev. de Geogr. Colon. y Mercantil*, Vol. 15, 1918, pp. 347–362).

The southern coast from Cape Leeuwin to the Nuyts' Archipelago was first explored by the Dutch in 1627 and was called by them Nuyts' Land. Ninety years later a curious proposal that this region be made the seat of a colony was presented to the Dutch government. The rare booklet of Jean Pierre Purry (1718) in which wholly theoretical arguments are advanced in favor of this scheme has been reprinted in part (*Proc. Royal Geogr. Soc. of Australasia: South Australian Branch*, Vol. 19, 1917–18, pp. 102–108). Purry maintains that because the Land of Nuyts lies "in the 5th climate, between the 30th and 36th degrees of latitude," and because the best and most fertile countries both of the Old and of the New World lie between these same parallels, that therefore the Land of Nuyts must be rich "whether in cheese, wine, olives, tobacco, or, chief of all, silkworms." Subsequent explorations by sea and land, however, have revealed this coast and the country behind it as among the most desolate and inhospitable regions in the world.

A useful summary of early voyages along the southern coast was given by the Hon. John Lewis in one of his annual addresses as president of the South Australian Branch of the Royal Geographical Society of Australasia (*Proc., etc.*, Vol. 19, 1917–18, pp. 1–95). By all means the most fruitful of these explorations was that of Captain Flinders in the *Investigator*. Flinders accurately surveyed the shore line and discovered the two great bays, Spencer's Gulf and the Gulf of St. Vincent, that penetrate far into the interior of South Australia. Full extracts from Flinders' detailed journal were given by President Lewis in the address just referred to and in that of the following year (*Proc., etc.*, Vol. 20, 1918–19, pp. 1–67). The best known incident of the voyage was an unexpected encounter south of Kangaroo Island with the *Géographe*. This vessel and the *Naturaliste*, both under the command of Captain Baudin, had been sent out by Napoleon Bonaparte to explore these southern waters. Though the Peace of Amiens had been concluded less than a month before, for all Flinders and Baudin knew, France and Great Britain were still at war.

Flinders, none the less, ventured aboard the French vessel, was received with courtesy by Baudin, and exchanged geographical information with the French commander. Subsequently Flinders was careful to preserve upon his maps names given by Baudin to points along the coast, and in 1913 the continued use of several of these names was officially approved by the South Australian government. On the other hand the official accounts of the French expedition written after the death of Baudin tended to deprive the British navigator of the credit due him for his pioneer work.

Though the first British settlement in Australia was made in 1788 at Sydney, the escarpment of the Blue Mountains to the west with its remarkable series of "bottle-neck" valleys for many years placed an effective obstacle in the way of exploration and expansion into the interior (see Griffith Taylor, *Geogr. Journ.*, Vol. 53, 1919, p. 177). During the infancy of the settlement at Sydney, a rumor became widespread among the convicts of the presence of a colony of white people some 150 or 200 miles back in the country. In 1798 two journeys were made under the command of Governor Hunter to investigate this rumor. Needless to say, no white people were found, but the district southwest of Sydney up to the mountain barrier near the site of the present city of Goulbourn was penetrated for the first time. The diaries of a young man who took part in these journeys have been recently printed and discussed in detail by Mr. R. H. Cambage ("Exploration beyond the Upper Nepean in 1798," *Journ. and Proc. Royal Australian Hist. Soc.*, Vol. 6, Part I, pp. 1–36). Not until the second decade of the nineteenth century, however, were more extended explorations undertaken on both sides of the Blue Mountain barrier and upon the plains to the west. In another interesting paper Mr. Cambage outlines and summarizes several significant journeys that were made at this time ("Exploration between the Wingecarribee, Shoalhaven, Macquarie, and Murrumbidgee Rivers," published by Royal Australian Hist. Soc., July 26, 1921).

The discovery of the great River Murray and the first passage overland from New South Wales to South Australia were made in 1829–1830 by Charles Sturt, who was later to open the way into the heart of the continent. Mr. Lewis, whose interest in the historical geography of Australia has been unflagging, in another Presidential address, dealt at length with the explorations of Sturt and others in the vicinity of the Murray and with early navigation on that stream (*Proc., etc.*, Vol. 18, 1916–17, pp. 2–74). A letter addressed by Sturt to the Under Secretary of the Colonial Office (R. W. Hay) and bearing the date 1834 was printed for the first time in the *Proceedings* (Vol. 18, 1916–17, pp. 89–104). Sturt pointed out the relative advantages and disadvantages of Port Lincoln and Kangaroo Island for prospective settlements and suggested that the strip of country between Mt. Lofty and the eastern shore of the Gulf of St. Vincent offered the most suitable site for the capital of a future colony. This was the site chosen only two years later by Colonel Light, to whom had been assigned the duty of selecting a location for the capital, and here the city of Adelaide was built. A well written account of the work of Sturt, Colonel Light, and other explorers of the coasts and interior of South Australia is given by Gwenneth Williams in a monograph entitled "South Australian Exploration to 1856" (Adelaide, 1919).

In spite of the construction of the telegraph line along the shore in 1877, Nuyts' Land of the Dutch (including the barren Nullarbor Plain, which, it would seem, is characterized by *karst* topography) remained only imperfectly known until as late as the opening of the transcontinental railway in 1917. One result of the popular interest in this district created by the building of the railway, was the publication in the *Proceedings* (Vol. 19, 1917–18, pp. 109–153), in the *Victorian Geographical Journal* (Vol. 30, 1913, pp. 1–17), and elsewhere, of many interesting data on explorations made there since 1860.

Among the more critical problems that face the Australian settlers after the preliminary reconnaissance of the country, is that of the removal of stock overland to remote quarters which it is hoped to develop for grazing. In 1838 Joseph Hawdon drove the first herd of horned cattle from New South Wales to Adelaide, a distance of over seven hundred miles, and was soon followed in the same undertaking by the explorers Sturt and Eyre. Letters describing these "overlanding" journeys of Hawdon, Eyre, and Sturt which first appeared in the *South Australian Gazette* in 1838 were reprinted in the *Proceedings* (Vol. 17, 1915–16, pp. 99–107). Since these early days numerous other "overlanding" expeditions have been carried out, often against desperate odds—as, for example, in the case of Kennedy and McGill who succeeded (1870) in driving a small flock of sheep westward around the head of the Great Australian Bight to the Nullarbor Plain (see *Victorian Geogr. Journ.*, Vol. 30, 1913, p. 3). Within very recent years a stock route has been opened from Willuna in Western Australia northeastward through more than six hundred miles of territory that had remained

almost utterly unknown until Canning's journey of 1907 (see *Western Australia Geol. Survey Bull. No. 61*, pp. 37 and 67–68).

PHYSICAL GEOGRAPHY

The Abyss of Cap-Breton, Bay of Biscay, and a New Explanation of the Origin of Submarine Trenches. Under the title of "Le Gouf de Cap-Breton," Commandant Ch. Gorceix presents in *La Géographie* for April, 1922, a somewhat detailed description and a novel explanation for the trench or abyss which leads an arm of deep water into the Gulf of Gascony at the inner angle of the Bay of Biscay. This trench has usually been interpreted in the same way as the apparently similar trenches opposite the mouth of the Hudson and many other rivers, as a continuation of a river valley that was eroded during a time of continental emergence, and drowned by recent submergence. Hull, Spencer, and Davidson have treated this problem for the western coast of Europe, the eastern coast of North America, and the coast of California. Gorceix gives a detailed contour map of the Cap-Breton trench, from which it appears to have a form of much irregularity, quite unlike that of a normal valley; and he explains the trench as the result of solution of submarine beds of gypsum and salt by warm water fed by a subterranean river that flows westward along a belt line from the northern flank of the Pyrenees. In support of this explanation he refers to the geological structure of the region and quotes a record of warm water discovered in the trench bottom by a temperature sounding, but he adds that further soundings are needed before the presence there of warm water in considerable volume can be regarded as proved. In response J. B. Charcot has come forward with a note to the French Academy of Sciences (*Comptes Rendus*, No. 19, May 8, 1922, pp. 1246–1247) giving soundings made by the *Pourquoi Pas* in June, 1913, and July, 1914. These soundings show an absolutely regular and normal decrease in temperature as the bottom is approached.

The amount of continental emergence and submergence demanded by the explanation of these submarine trenches as river valleys is in some cases as much as 5,000 or 8,000 feet, and that alone makes the explanation seem improbable. If the emergence and submergence are explained as the result of an up-warping and down-warping of the submarine shelf, marginal to the continent, instead of as the result of a massive and uniform movement of an entire continent, the explanation might be regarded as less strained. But if other trenches are found to exhibit such irregularities as those which characterize the abyss of Cap-Breton, it may be advisable to explain them all as of submarine origin, without the aid of changes of level. In that case the relation often found between offshore trenches and on-shore rivers would have to be regarded as accidental; yet in several instances this relation is so close as to seem causal. The whole problem is evidently open rather than closed.

W. M. Davis

GEOGRAPHICAL NEWS

Establishment of an International Hydrographic Bureau. A new evidence of international co-operation in matters of scientific interest and world-wide utility is to be found in the organization last year of an International Hydrographic Bureau situated at Monaco and supported by the governments of twenty-two maritime countries. By this step taken by the official hydrographic services of the various governments a number of aspects of the oceans and coasts now for the first time has become the subject of organized international co-operation. Official collaboration in such matters in the past has been limited chiefly to the exchange of charts by the leading national hydrographic offices. Men of science for a number of years have worked together in the study of oceanography in its biological and in many of its physical aspects. Thus the International Council for the Study of the Sea has been in existence since 1901 and has conducted a number of valuable researches. International oceanographical congresses have been held on several occasions since 1899; while the Prince of Monaco, largely by his own effort, has succeeded in compiling the uniform bathymetric chart of the oceans, thus utilizing the data of many governments; and it would seem to bode well for the contact of the new Bureau with oceanographers in general that the seat selected for it is Monaco.

From now onwards the principle is established that all information about the coasts and the oceans gathered by official departments is to become available to all other similar departments which adhere to the International Hydrographic Bureau, and the adherents are to have an opportunity for open discussion at a conference every fifth year.

The author of the idea was the late Joseph Renaud, Director of the French Hydrographic Service. At a preliminary conference held in London in 1919 a committee consisting of M. Renaud and the Hydrographers of Great Britain and the United States began its labors of organization, and within a year practically all the invited States had approved of their recommendations.

The main objects of the Bureau are to co-ordinate the efforts of the various Hydrographic Services with a view to rendering navigation easier and safer on all the seas, to obtain as much uniformity in hydrographic documents as possible, and to advance the theory and practice of hydrography. The Bureau has no authority over the national Hydrographic Offices; it is a consultative body. Its functions may be summarized as follows:

The maintenance of up-to-date collections of charts and other documents issued by the various Hydrographic and Meteorological Services, together with the preparation of a list of such hydrographic documents as are of historical interest, and their whereabouts.

Study and research upon all subjects which affect hydrography, including instruments and survey methods.

Publication of various lists such as those of geographical positions, and the distribution of information regarding new surveys, etc.

Advice, when asked for, which will aid governments in establishing Hydrographic Offices, or in developing those already established.

The Bureau has unfortunately been deprived, by his death, of the further services of M. Renaud on its Directing Board. This Board, elected for five years, consists of Vice-Admiral Sir John Parry (Great Britain), President, and representatives from the Netherlands and Norway. The address of the Bureau Hydrographique International is 3 rue du Port, Monaco, and the Secretary-General is Captain G. Spicer-Simson (*Geogr. Journ.*, April, 1922).

Obituary

Thorvaldur Thoroddsen. The well-known Icelandic geographer and geologist, Thorvaldur Thoroddsen, died in Copenhagen on September 30, 1921, after an illness of several months. He was born in Iceland on June 6, 1855, and studied in the universities of Copenhagen and Leipzig. For many years he was teacher in the College of Reykjavik until 1899, when he moved to Copenhagen and devoted himself to research and writing. As a young student he accompanied in 1876 Professor Johnstrup on his expedition to investigate the Icelandic volcano Askja, and this directed Thoroddsen to what became the task of his life. He realized how imperfect was existing knowledge about the nature of his native land, and in 1881 he began exploring it; with public and private support he continued this exploration often under great difficulties almost every summer until 1898, having then visited all parts of the country. The results of these explorations he published from time to time in various Icelandic and foreign periodicals. In 1900 appeared his geological map of Iceland, a few years later his important descriptive work, "Island: Grundriss der Geographie und Geologie" (*Petermanns Mitt. Ergänzungsheft No. 152*, 1905, and *No. 153*, 1906). "An Account of the Physical Geography of Iceland with Special Reference to the Plant Life" appeared in 1914 as a part of "The Botany of Iceland." He was a prolific writer, and in Icelandic there are several large works from his pen, such as a history of Icelandic geography (in four volumes, the first two of which were translated into German); on earthquakes in Iceland; on the climate of Iceland during the last thousand years; an account of his explorations and travels (in four volumes); a comprehensive description of Iceland, which he left unfinished, four volumes having appeared at the time of his death; and many other smaller writings. His most important contributions to science were his writings on volcanism. When he began his explorations only about 30 volcanoes were known in Iceland, but he found there at least 130. No one had so varied and wide knowledge about his native land as Thoroddsen; he was a historian as well as naturalist. He was an attractive personality, a cultured and widely read man with many interests. In recognition of his work he received many honors. In 1894 the University of Copenhagen made him a doctor *honoris causa*, and in 1909 he was elected member of the Danish Royal Academy. In 1906 he received the Daly medal of the American Geographical Society and he also held gold medals from the geographical societies of Copenhagen and Paris and the Linné medal of Stockholm. He was honorary member of several scientific societies.

H. Hermannsson

GEOGRAPHICAL REVIEWS

Oceanic Cultures

A. C. Haddon. **Migrations of Cultures in British New Guinea.** Maps. *Journ. Royal Anthropol. Inst.*, Vol. 50, 1920, pp. 237–280. London.

A. C. Haddon. **Racial and Cultural Distributions in New Guinea.** Maps, bibliogr. *Geogr. Teacher*, No. 59, Vol. 12, 1921, Spring, pp. 15–19. London.

R. B. Dixon. **A New Theory of Polynesian Origins.** *Proc. Amer. Philos. Soc.*, Vol. 59, 1920, pp. 261–267. Philadelphia.

"A New Theory of Polynesian Origins," by R. B. Dixon, Ph.D.: A Review. *Journ. Polynesian Soc.*, Vol. 30, 1921, pp. 79–90. New Plymouth, N. Z.

T. R. St.-Johnston. **The Islanders of the Pacific, or the Children of the Sun.** 307 pp.; maps, ills., index. T. Fisher Unwin, Ltd., London, 1921. £1, 5s. 9 x 6 inches.

It is little wonder that with the Pacific so suddenly thrust into the foreground of international politics and diplomacy, the ethnological world of Europe, America, and Japan should be making a new effort to unravel some of the problems connected with its peoples. At the close of the late war the Government of Japan sent out an ethnological party to the islands north of the equator, and at this present moment a scientific expedition from America is working in the South Seas under the auspices of the Bishop Pauahi Museum of Honolulu. The publications listed at the head of this review are only a tithe of the literature on the subject that is constantly issuing from the printing presses of the different countries.

The island of New Guinea lies at the gateway of the Pacific, and it has experienced in consequence nearly all the cultural influences that have affected that region. The varieties in physical type of its inhabitants, the divergences in social organization, material culture, and language between even neighboring settlements, are amazing. But the confused mass of ethnographic data from the island is gradually being systematized through the labors of Dutch and German scientists in the west and north and of English in the south and east. The two articles by Professor Haddon outline the main racial and cultural distributions as far as they are known at present. The population is divided into three groups, partly on linguistic grounds, and partly on the basis of physical type. The earliest inhabitants were probably the pygmies, a Negrito people found in a relatively pure state only in the mountains of Netherlands New Guinea but discernible in a mixed form in many other parts of the island; nothing is known concerning their language. Next come the so-called Papuans proper, who greatly resemble the pygmies but are taller and have noses that are frequently curved. Their languages are all classed as Papuan, although it is very doubtful whether they form a single linguistic group. Finally, in the northeast and southeast, are the Papuo-Melanesians, indistinguishable from Papuans in many places as far as physical appearance is concerned, although in the southeast there is a tendency towards lighter skin color and less woolliness or frizziness of hair. The main reason for separating them from the Papuans is a linguistic one, all their dialects being varieties of Melanesian and hence belonging to the great Austronesian family of languages.

The Papuo-Melanesians were evidently the latest immigrants. Professor Haddon seems to consider that they reached New Guinea in at least two main migrations, each with its distinctive culture, but both from Melanesia. Friederici, on the other hand, holds that one migration came direct from Indonesia, passed along the north coast through Vitiaz Strait, and colonized the southeastern end of the island without going on to Melanesia proper. Important evidence on this point could probably be gained by an intensive study of the inhabitants of Rossel Island, the most easterly island in the group of archipelagoes that lie off the southeastern end of New Guinea. All the other islands in this region are Melanesian in language and culture, but the natives of Rossel Island speak a Papuan language; and their culture, what little is known of it, seems to be intermediate in character.

The similarity between the cultures of the north coast tribes and those of the Gulf of Papua on the south coast has been known for a long time, but Professor Haddon has

proved it to be much greater than was generally recognized. He ascribes it, not to intercourse and the spreading of culture elements from one tribe to another, but to a migration of peoples from the north coast over the interior range of mountains to the south. There must have been some very compelling motive for a migration over such difficult country, and one may suspect that it was not unconnected with the descent of Melanesians upon the north coast. But as long as our data remain so scanty it is rather fruitless to speculate on such a topic. Few of the tribes even in the coastal regions have been adequately studied, while of the interior we know very little. The distribution maps that Professor Haddon has published and the few generalizations that he ventures to base on them give the most accurate summary we can expect at present of the ethnography of the island.

The article of Dr. Dixon covers not only New Guinea but the whole of the Pacific. He has attempted to separate out the different strata that have gone to make up the population of this area by analyzing the prevailing physical types as shown in the cranial measurements recorded by different writers. Data even from this source are limited, and there is no means of correlating the specific features with stature, skin color, or the color and shape of the hair; these are limitations that Dr. Dixon himself frankly admits. But with the available material he has mapped out his area and drawn from the geographical distribution of his cranial types certain conclusions which are both novel and in some respects startling. It is true that they are given as tentative only; but the method employed is essentially sound, and it is to be hoped that his article will stimulate more researches along the same lines.

The conclusions he draws are as follows. The underlying stratum throughout the whole of the Pacific is the Negrito, the type of dwarfish, black-skinned woolly-haired native who can still be found in the Philippines, the Malay Peninsula, and, we may add, the interior of New Guinea, where a pygmy people, prophesied by Haddon, was discovered later by Wollaston. Overlying the Negritos is a stratum of Negroid peoples such as now form the bulk of the population of Melanesia and Australia; they absorbed the Negritos to such an extent that the earlier type survives east of New Guinea only in Kauai, the most northern island of the Hawaiian group, although derivative forms may be traced on the eastern and southern margins of the Pacific area, particularly in Easter Island, the Marquesas, and New Zealand. Nearly synchronizing in time with the Negroid invasion was a wave of Caucasic people, evidence for which is also found in Hawaii and New Zealand. Both the Negroid and Caucasic peoples were then pushed out to the margins of the area by a wave of Malayan or Mongoloid strain, which blended slightly with the earlier inhabitants and became the Polynesians now predominating throughout the northern, eastern, and southern portions of the Pacific.

The theory, as we have seen, is based purely on the distribution of cranial types and will probably need modification as more data accumulate. Several difficulties at once suggest themselves. The Negrito element is certainly present in New Guinea and almost as certainly in Melanesia, but for its diffusion throughout the Pacific there seems to be no evidence of any kind apart from cranial type. For the wide diffusion of the Negroids, on the other hand, there is abundant proof not only in present-day physical types but in archeological remains, as at Easter Island, and in the traditions of most of the island groups. Percy Smith accounts for it by the presence of Melanesians as serfs and crews in the ships of the Polynesians; but, unless it was afterwards swamped by a further wave of Polynesians who brought their wives with them and passed through Melanesia without amalgamating with the darker peoples, we should expect to find the Negroid element as pronounced in central Polynesia as on the outskirts. The diffusion of certain cultural traits supports the theory that the Negroids once covered the Pacific at least as far as Easter Island. Thus the chewing of lime and betel nut in the western Pacific and the similar chewing of coca and lime in South America almost certainly had a common origin. The Polynesians proper never adopted the custom, as far as we know; and it seems more reasonable to assume that it spread to South America from a Negroid population inhabiting the eastern Pacific than from mixed Polynesian and Negroid serfs who had probably ceased to practice it. But, while we may accept the theory of the priority of Melanesians to Polynesians in Oceania, the case for the earlier priority of Negritos is less clear. If Dr. Dixon's data are accurate it would seem rather that the first Negroids who reached the Pacific were mingled with Negritos; and the Negrito element, being twice submerged, is indistinguishable now except on the outskirts.

Another difficulty in Dr. Dixon's theory is the common origin he ascribes to the bulk of the inhabitants of Australia and Melanesia. Even physically there is a vast difference between the two peoples, the former being almost black with curly or merely wavy hair, while the latter are a dark chocolate only, with hair noted for its frizziness. There may be, of course, and probably is, a common strain in both; but as the evidence now stands Australia would seem to contain a very early Negroid stock differentiated from all others by straighter hair. It is worth noticing in this connection that while Australian languages have been divided into two groups, neither of them can as yet be affiliated with any other known language. It is true that certain culture elements are held in common by both Australians and Melanesians, such as the dual organization of society and totemism, but similar elements are found in North America as well. More evidence is required, therefore, before we can safely include Australia and Melanesia in the same Negroid group.

Dr. Dixon's Caucasic type, which he suggests appeared in company with the Negroid, is frankly a mystery. There can be no question here of the oft-attempted derivation of Polynesians from a Caucasic or white stock, for Dr. Dixon's type is distinguished from the brachycephalic Polynesian by its long-headedness. Nor can we correlate it with any definite culture; it will not fit in, for example, with Rivers's "kava" and "betel" immigrations, or with the two streams of migrants from Indonesia into Melanesia traced by Friederici. Perhaps the Bishop Pauahi Expedition may throw more light on this phase of Dr. Dixon's theory.

The Malayoid or Mongoloid origin ascribed to the last wave of immigrants into the Pacific, the Polynesians proper, is in line with all the latest evidence. The measurements of living Samoans made by Gifford and McKern in 1920 serve to confirm it. For Sullivan, in working up these measurements, concluded (1) that it was far more difficult to reconcile European racial origin for the Samoans and Polynesians in general, than to assume Mongoloid affinities and origins; and (2) that, considering the Samoan group as a unit, there is very little Melanesian blood in evidence. That Mongoloid, not Caucasic, is the predominant strain in their blood, is supported by the theory of Father Schmidt, now accepted by most linguists, that both the Melanesian and Polynesian dialects are to be affiliated with the great Mon-Khmer group of languages of Farther India and the Malay Peninsula. Oceanic traditions, so exhaustively recorded and analyzed by Percy Smith and his fellow workers, point undoubtedly to southeastern Asia as the original home of the Polynesians. These traditions give us not only the approximate dates of their voyages of discovery and colonization of the different archipelagoes in Oceania but even fix the date at which they left Indonesia; it can hardly have been earlier than the beginning of the Christian era and certainly no later than the end of the fourth century.

It is but a short step from the realm of legitimate theory to the region of pure speculation. Colonel St.-Johnston's book, we fear, falls largely in the latter sphere, although its compactness and broad handling of its subject and its numerous excellent illustrations will give it a wide appeal among the general public. The author is well acquainted with Fiji from his long residence there as a District Commissioner. By browsing through much of the literature relating to the other islands of the Pacific he has become familiar with many of the theories prevalent in England and New Zealand concerning the origins of its peoples. While trying to reconcile all these conflicting theories he gives special prominence to one of them—the supposed entrance into the Pacific, at a rather uncertain date, of a people who introduced the custom of building megalithic monuments associated with the worship of the sun. Here and there throughout his book are little Frazerian touches describing how cannibalism, taboo, and sun worship may have arisen, and how the last developed into fire worship, ancestor worship, and fertility worship, favorite subjects of investigation a quarter of a century ago but rather avoided now by cautious ethnologists, who feel more and more that long centuries and millennia lie at the back of the very simplest elements of culture, that customs and institutions change and undergo reinterpretation like other phenomena, and that it is almost as difficult to discover the real origins of religion and totems and clans as it is to discover the origins of fire or of the family unit. But Colonel St.-Johnston is writing frankly for the general public, who demand intelligible and convenient theories to explain these problems. More interesting are the pages of his book in which he attempts to work out his main theory—that the Pacific has been the home of three successive peoples, now blended in many places: (1) Negritos of the type that still remain in the Andaman and Philippine Islands to the west; (2) Melanesians, descendants of early Dravidians, a part of the "dark Caucasian"

division of mankind, driven some time after 2500 B.C. from India into Indonesia where they blended with "Armenoids" from western Asia and moved on into the Pacific, peopling most of the islands and probably reaching America; (3) Polynesians, "Aryan" seafarers from Mesopotamia and southwestern Asia, who came by sea to Java before 500 B.C., pushed eastwards not long after the beginning of the Christian era, drove out or exterminated the earlier Melanesian inhabitants in the eastern Pacific, and even roamed over a large part of America. The last-named are his sun worshipers *par excellence*, who have left their traces in megalithic monuments in all portions of the globe, in Mexico and Peru, the islands of the Pacific and Indonesia, western and northern Asia, North and South Africa, and western Europe. Myths and traditions, burial customs, insignia of royalty, cannibalistic rites, fire walking, sacrificial offerings, kava drinking, and linguistic data are invoked, one after the other, in support of the theory. The chapter on "Language and Place-Names" is characteristic of Colonel St.-Johnston's methods. He considers Polynesian as "virtually the extinct Turanian language." "Turanian is of the type known as agglutinative . . . [and] the general tendency is for the agglutinative type to change on further development into the inflectional type. Two well-known inflectional languages that succeeded the Turanian were the Semitic and the Aryan." "Egyptian, Assyrian, Arabic, Persian, Indian, and even Mongolian languages have all brought their quota to the ultimate result of 'Polynesian' as we know it." "Another word common to England, Greece, and Polynesia is sea-urchin, seen as ἐχῖνος (Greece) and ekina (New Zealand)."

The book as a whole makes very interesting reading, especially the little original anecdotes of native life in Fiji. It will do valuable work in drawing the public attention to the complexity of Oceanic cultures and to the vast historical problems that they involve; but the writer's arguments contain too many unproved hypotheses and too many false generalizations for his solutions to be accepted at their face value.

D. JENNESS

ETHNOLOGY OF THE COPPER ESKIMO

D. JENNESS. **The Life of the Copper Eskimos.** 277 pp.; maps, diagrs., ills., bibliogr., index. (Report of the Canadian Arctic Expedition 1913–18, Vol. 12. Southern Party, 1913–16.) Dept. of the Naval Service, Ottawa, 1922. 9½ x 6½ inches.

This appears to be the first, or preliminary, report of the anthropological results of the Expedition and, according to the author's statement, is addressed to the general public, in contrast to future volumes upon music, language, material culture, etc. which will be of a more technical character. We are reminded at the outset that the misfortunes of the Expedition and the untimely death of M. Henri Beuchat disarranged the plans of the party, preventing the author from reaching his objective, the Copper Eskimos, until the autumn of 1914 where he, as the sole anthropological survivor in the Southern party, undertook to carry on alone all the phases of the investigation. With this task he occupied himself, as circumstances permitted, until July, 1916, something less than two years. In fact, the time of actual contact with the Eskimos was much less; thus the first Eskimos were met on November 19, and subsequently it was not possible to keep in constant contact with them. Nevertheless, owing to his experience elsewhere and his manifest genius for the work, the author seems to have gathered a large amount of data. His task, as he conceived it, was to follow the lead of Stefansson, the first technical observer of these Eskimos; for he states that "Mr. Stefansson obtained an astonishing amount of very valuable information in a comparatively short space of time, and while it was inevitable that a certain number of errors should have crept into his accounts, yet his works will always stand as the basis on which future investigators will have to build" (p. 11).

The subject matter of this preliminary report is, in the main, organized under such conventional topics as distribution and trade, houses, society, the food quest, marriage, birth, death, religion, and amusements. In addition, there are descriptive sections on the country and a chapter on psychology and morality.

As those familiar with the reports of the earlier Stefansson expeditions know, the home of the Copper Eskimos is along Coronation Gulf, on the north side in Victoria Island, as well as on the south side, on the Canadian shore, some 30° west of Hudson Bay. As during more than half the year the Gulf is frozen over, it presents no great barrier. One feature of the Copper Eskimo habitat should be noted, it lies across the great road of seasonal migration for the caribou; hence, so long as these herds survive, they will in season be accessible to these Eskimos. Between times, there are the immediate inland

waters for fishing and fowling and in winter the Gulf for sealing. It may be remarked that this is the locality chosen by the late H. P. Steensby as the most probable birthplace of Eskimo culture and, therefore, to be regarded as the environment most favorable to such a culture. Anyway, there is good reason to believe that the culture of these Eskimos is highly typical of the whole. Consequently any such contributions as the volume under consideration are doubly welcome, for already the culture of these people is losing its primitive character by the introduction of firearms, iron tools, and new methods of livelihood. Our author may thus be the last to come in contact with this original, but now passing, type of Eskimo culture (see also D. Jenness: The Cultural Transformation of the Copper Eskimo, *Geogr. Rev.*, Vol. 11, 1921, pp. 541–550). Yet we are warned on page 47 that later the author will bring forward proof that the Copper Eskimos reached the Coronation Gulf region but recently. The wisdom of withholding so important a matter is certainly questionable; the logical place for it is in the present volume, for upon this hinges the interpretation of the data presented.

Though, as the author states, material culture and technology are to be treated in a later volume, he gives us a long detailed account of houses and tents and another of food. These chapters leave little to be desired as to content. The varieties of shelter, both in summer and in winter, are given *in extenso*, and the range of food, methods of eating, etc., are portrayed. The lack of wood in their habitat dooms the Copper Eskimos to houses of snow and skin, while the fauna leaves them but three dependable staples, caribou, seal, and fish, which unfortunately have their seasons of accessibility. Hunting, sealing, and fishing are described to complete the narrative. A unique section, however, is that dealing with the winter and summer life of the group, or following the calendar around. While the northern Indians congregate in summer and scatter in winter, the reverse holds for the Copper Eskimos; for they live in large villages on the ice in midwinter, begin to scatter in the spring, and finally spread out inland for fishing and hunting, to come together again when the ice begins to form in September and October. The author followed one group through its round of life and gives in detail a diary account of the doings of his companions from April 14 to November 8, inclusive. During this interval the party crossed to Victoria Island and wandered about, east and west, over some 4° of longitude; but it is quite impossible to summarize further the discussions of social life, religion, etc., that follow, for the text deals with real events and individual happenings.

In the way of adverse criticism, it may be noted that the form of the work and the lack of topical headings, with some laxity of organization, will detract from the value of this volume as a work of reference. Fortunately, a topical index is provided, otherwise the reader would be compelled to scan numerous pages for the data desired.

Finally, the author and all those responsible for the Expedition and its results are to be congratulated upon this volume which, as supplementary to Stefansson's initial account, goes far to fill the gap in our knowledge between the Eskimos of the West and those of Hudson Bay. As this is the first of a series of five volumes, we may expect that the culture of the Copper Eskimo will become the best known of all.

CLARK WISSLER

TRAVEL AND POLITICS IN EASTERN AFRICA

SIR ALFRED SHARPE. **The Backbone of Africa: A Record of Travel During the Great War, with Some Suggestions for Administrative Reform.** 232 pp.; maps, ills., index. H. F. & G. Witherby, London, 1921. 16s. 9 x 6 inches.

In this book, dealing with the highlands of eastern Africa, Sir Alfred Sharpe has given us a volume of unusual interest, largely political, partly a frank expression of vexed questions of policy, at times the experience of a traveler with an eye to the economic future, and again, merely that of the enthusiastic hunter of big game. Its author was administrative head of Nyasaland for many years and traveled extensively in that region and in Northern Rhodesia, the eastern Congo, Ruanda, Uganda, and Kenya Colony and is thus well qualified to speak on his subject.

The Kivu region of the eastern Congo apparently left the deepest impression upon him. Here is a country of unexcelled climate and of rich pastures of grassland where cattle do well and which is commercially almost untouched by the white man. In Nyasaland, where European settlement has progressed rapidly, coffee, formerly the most important European

crop, is giving way to cotton and tobacco. Not only do the white landlords grow American upland cotton, but by a co-operative scheme the natives also are growing cotton, which they sell to the Europeans at about one penny a pound (including seed). This greatly increases the total production. Fiber, chilies, and Ceará rubber are also produced, the latter at a cost of about three shillings and sixpence a pound. In Uganda, especially around Lake Kiogo, there is a great increase in cotton production, while both Uganda and Kenya are producing coffee, cotton, and sisal.

Manifestly, if produce is to be sold and shipped, rail lines must be extended. There are so many plans suggested in developing Africa's railroad system that it is almost confusing to consider them. Sir Alfred considers only those which may reasonably be regarded as probable within a few years. Nyasaland is already a productive country and needs access to a good harbor. To this end a rail line is being developed from Beira in Portuguese East Africa which will cross Zambezi near Chindio where it will join the Nyasaland railway, thus giving a continuous passage from Blantyre to Beira. This rail line may be extended to Fort Johnston and Nyasa and a projected line east to Fort Jamison in Northern Rhodesia. It is also probable that a railroad 230 miles long will replace the Stevenson road between Nyasa and Tanganyika. The Portuguese may build in from Pemba Bay to Nyasa at M'tengula. As a further development of the rail transport for the Nyasa lake region the author suggests a line from Morogoro or Kilossa on the Central Railway to the Langenberg district.

The rich cattle lands of Urundi and Ruanda and of the eastern Congo offer to the future the possibility of commercial exploitation. Several lines are projected to the country. One may run from the upper end of Tanganyika to Lake Kivu through the Rusizi valley, another may run from Bukoba on Victoria Nyanza to Kivu, and still another may follow the old German prospect and run from Tabora to some point in Ruanda (see map, p. 356 of this *Review*).

Great interest is shown in the Kilo-Moto gold mines of the northeastern Congo. These are unusually rich placer deposits which are easily worked by natives under Belgian direction, the profits going to the government. Three possible routes of communication to the Kilo-Moto region are mentioned—one by way of Stanleyville on the Congo, one leading north to Rejaf on the Nile, and one by an extension of the Uganda railway, which would bring Kilo within 28 days by rail and boat from Marseilles.

Sir Alfred is of the opinion that the phrase "Cape to Cairo Railway" (see *Geogr. Journ.*, Vol. 52, 1918, pp. 141–157) does not mean much, since most of the purposes of export are met by lines leading to the nearest seaboard, and the long central line cannot hope to compete with these. He mentions the possibility of extending the line from El Obeid to El Fasher, and possibly across to West Africa. Robert Williams, who has been so great a factor in railroad construction in South Africa and who is the successor to Rhodes in this respect, states (*African World*, April 8, 1922, pp. 338 and 392) that in about four years the Benguela railway will connect with the Belgian Congo railways and that during the past year an expedition has been at work to extend the Sudanese railway south to join the Uganda railway. Another suggested line would lead from El Obeid to Stanleyville. This would make possible the passage from Cape Town to Cairo by rail and steamer.

The position of the native under white domination is a matter that naturally comes up for discussion. When a primitive people first come under control of the white race they show no especial interest in over production and consequently offer the white man no chance of deriving profit from them. The first problem is, therefore, that of getting them to work. This is usually represented as being done in the interest of the black himself, but the profit so obviously accrues to the white man that his assigning it to altruistic reasons is probably only a clearer proof that he realizes the selfishness of his acts. The author, who was for years governor general of Nyasaland, states frankly that to enforce labor on a primitive race would not be tolerated by civilized man. He then points clearly the way by which this enforced labor is accomplished, presumably without offending the finer sensibilities of the same civilized man. First, a head tax (or a hut tax) is placed on the native. To earn this money he must work for the white man. In Nyasaland the hut tax, which is relatively low, amounts to eight shillings a year and is reduced to four if the hut owner works as a paid hand for a European within the protectorate for one month during the year. The white man thus secures labor which can hardly be called voluntary, and the government likewise is repaid for any service it may have rendered. Taxes are often high, and it is this method that produces the bulk of native labor. There are other methods employed. The native is taught or forced by custom or regulation to wear clothes. These he must buy.

His appetite for new foods and new drinks is developed. It is not long before he is entirely removed from the social life he previously enjoyed, from the domestic activities of his race, such as preparing new land, building new houses, hunting, dancing, and fighting, and is forced into a life in which he devotes much of his time to serving the white man. These are the first steps in his civilization.

The position of the missionary is a difficult one. Often without so intending he becomes a part of the system outlined above. The better class of missionary, however, realizes that the tribe has been adapted to its surroundings by hundreds of years of trial and error and that suddenly to break down their social system is a very dangerous thing. Such missionaries, building gradually on the substantial foundation of right and wrong which the tribe has developed, are slow to introduce clothing, new customs in marriage, or other changes which too often lower the moral tone of the native and give him nothing really substantial in its place. Sir Alfred frankly states that civilization and morality are inversely proportional in the natives of East Africa.

Disrespect of the white man for the social system established by the black is unfortunately characteristic of too large a number of administrators. Temple in "Native Races and Their Rulers" (Cape Town, 1918) emphasizes the importance of maintaining the tribal organization and supporting the native rulers. In Urundi and Ruanda the Belgian officials are supporting the native rulers and are not interfering with the native customs and practices any more than seems justifiable and for the interest of the natives themselves. To enter a country and break down the long established social order seems hardly justifiable. The Watusi are a superior race (see the reviewer's article on Urundi elsewhere in this *Review*). Sir Alfred, however, holds them in contempt and suggests that their cattle and lands be taken from them and distributed to the Wahutu, or subservient, race. While many would agree that the subservient Wahutu should force this readjustment, just as certain forces in England are interested in seeing the industrial and landed aristocracy forced from their present position of security, it seems strange that the author should advocate an outside power's forcing this change on the people of Urundi and Ruanda. The Watusi, who are regarded by most travelers as a proud, haughty, and superior race, are by no means effeminate. If they were, the Wahutu, who outnumber them ten to one, would soon displace them. Administrative officers too often stamp out the strong, independent groups and favor races which are far inferior and which, because of their docility and weakness, are much more amenable to white domination.

Another important problem in connection with native labor is the degree to which natives should be moved from place to place, or even leave the country for employment in a distant protectorate. Europeans are opposed to the migration of native labor from the protectorate in which they live to adjacent countries; but where labor is deficient they are equally in favor of importations. Such migrations, or even the movements of large bodies of laborers within the colony, rapidly break down the native social system. The amount of labor available in Nyasaland is estimated by the author as 200,000 blacks who are willing to work a few months during the year for the 1,000 whites.

Land policy is as important as labor policy. In most tribes the chief holds all the land and allots this to his people. He can dispose of it to the whites. In any case the land gradually passes from the natives to the whites, unless the government adopts strenuous preventive measures.

In developing the agricultural production of the natives it is important to protect them from fluctuating prices. The author suggests that a bonus may be returned to the native during years of unusually good market and in this way he may not become discouraged when low prices follow good prices.

The author suggests sweeping changes in the administration of East Africa. He would shift responsibility from the central Colonial Office to the colonies themselves, thus insuring more intelligent management. In this way the Crown Colony—a local benevolent autocracy—would give way to local self-government as the number of Europeans increased. As long as the executive is purely official and the legislative body is appointed by the home government, the colonists have no real status or influence; and the fact that crown land can only be leased and cannot be acquired does not encourage settlement or permanent development.

He would unite under one administrative head all British territory south of the Anglo-Egyptian Sudan and north of the Zambezi and establish the seat of government at Zanzibar. This colony would be known as the "Colony of British East Africa" and would include colonies, protectorates, and mandated territories alike. It would be composed of three

minor divisions as follows: (1) Nyasaland, Northern Rhodesia, and portions of Tanganyika Territory, with headquarters at Zomba in Nyasaland; (2) Uganda, Kenya Colony, and part of Tanganyika Territory, with headquarters at Nairobi; (3) Zanzibar, Pemba, Mafia, and the remaining part of Tanganyika Territory, with headquarters at Zanzibar. The new southern boundary of Uganda would run west from Emin Pasha Bay on Lake Victoria to the Belgian boundary; the southern boundary of Kenya Colony would run from Speke Gulf or Lake Victoria to the coast south of Pangani River. Nyasaland would be increased by the block lying south of the eighth parallel and west of longitude 34° 30′ E.

Thus there would be set up in East Africa a great colony. Its relations to South Africa would be interesting. It is not unlikely that Southern Rhodesia and possibly Northern Rhodesia will soon become part of the Union of South Africa. Tanganyika Territory was eagerly conquered by South Africans and, had it not been for restrictive administration, would probably have been rapidly settled by them. There is plainly a gradual northward migration which will possibly result in the union of all the South and East African British domain under a single government. While the suggestions advanced in this book may, if followed out, tend to slow down this development at first, they may in the end hasten the final accomplishment of such a union. The wealth of this great block of land and the variety of its natural resources would seem to point clearly to the development here of a great nation at no very distant date.

H. L. SHANTZ

LIFE AND EXPLORATION IN AFRICA

ERNEST BAKER. **The Life and Explorations of Frederick Stanley Arnot.** 334 pp.; map, ills., index. E. P. Dutton & Co., New York, 1920. $5. 8¼ x 6 inches.

RENÉ BAZIN. **Charles de Foucauld, explorateur du Maroc, ermite au Sahara.** 479 pp.; map, ills., bibliogr. Plon-Nourrit & Co., Paris, 1921. 10 frs. 8 x 5 inches.

EDOUARD FAVRE. **La vie d'un missionnaire français, François Coillard, 1834–1904.** viii and 320 pp.; map, ills. Société des Missions Évangéliques, Paris, 1922. 10 x 6½ inches.

H. RAYNE. **Sun, Sand, and Somals: Leaves from the Note-Book of a District Commissioner in British Somaliland.** 223 pp.; ills. H. F. & G. Witherby, London, 1921. 12s., 6d. 9 x 6 inches.

MANFRED NATHAN. **The South African Commonwealth: Constitution, Problems, Social Conditions.** xi and 483 pp.; index. The Specialty Press of South Africa, Ltd., Johannesburg and Cape Town, 1919. 30s. 8½ x 5½ inches.

By their wide diversity of subject matter these five books of life and exploration give an interesting and comprehensive picture of the great variety of topography, climate, and life embraced within the African continent. The viewpoint of each author is the intimate, appreciative attitude of one who knows first-hand whereof he speaks. Each in his own way tells the story of the reaction of Africa to foreign invasion, whether it be of the French in Morocco, the British and Dutch in South Africa, the Arab and British on the Gulf of Aden, or the missionary, Catholic or Protestant, in the heart of the continent.

Mr. Baker, in "The Life and Explorations of Frederick Stanley Arnot," has really acted only as the editor of Arnot's own diary and letters, supplementing them with a bit of biography and filling in the gaps from his own knowledge. Arnot took his early inspiration for missionary work in Africa from none other than Livingstone himself. Refusing to ally himself with any of the Missionary Boards working in Africa, he made his first trip to that continent as a free-lance missionary in 1881, landing at Cape Town, and began his journey at Durban, in Natal, with the intention of following the Zambesi to its source where he expected to find a mountainous, healthy country in which to establish a missionary center. Much of the ground covered on this first trip had been previously traversed by Livingstone, who was still remembered by many of the natives. Arnot found the location he sought in Garenganze in northern Rhodesia. Of great interest are his explorations in the region Livingstone called the "Great Sponge of Central Africa," in the Lovale and Lunda country around Lake Dilolo, where within an hour's journey of one another he found streams running in nearly all the directions of the compass. Arnot made nine journeys in all to Africa during a period of thirty-three years and, in addition, a trip to British Guiana. The results of his endeavors are the establishment in the neighborhood of the

Central Plateau of Africa, of sixty-one missionaries in sixteen stations in five mission fields.

M. Bazin, also, has resorted extensively to the writings and letters of Charles de Foucauld, whose life as an explorer in Morocco and a Trappist hermit in the Sahara is the subject of his book. In fact the chapter entitled "L'Explorateur" is largely a summary of De Foucauld's own book, "Reconnaissance au Maroc." Foucauld, an Alsatian by birth and of a line of French nobility noted for centuries for devotion to Church and country, had his interest in Africa first aroused when he was sent to Algeria as a lieutenant in 1880. Dismissed from the army on account of a scandal of which he was the central figure, he returned to France but came back again to Algeria to take part against the revolution in South Oran in 1881. Morocco, because of its mystery and reputed impenetrability, attracted him as the proper field for the sacrifice which he felt called upon to make to expiate his wrong against his country. Disguised as a Jewish rabbi, since all but Jews and Moslems were *personae non gratae* in Morocco, accompanied by a Jewish rabbi and equipped with sextant and chronometer, he entered the country by way of Tangier, June 21, 1883. His route was by way of Fez across both the greater and lesser ranges of the Atlas and back to Mogador on the coast. On the return trip he again crossed the Atlas Mountains and followed their eastern slope to the Algerian frontier. The remainder of the book is devoted to the conversion and ordination of De Foucauld as a Trappist monk and his service as a hermit missionary in the Sahara.

Edouard Favre, in his preface, writes, "Nous avons laissé parler Coillard," and his book, like the two preceding, is very largely autobiography. François Coillard, a native of the province of Berry in central France and of Huguenot ancestry, spent most of the years of his missionary work in Africa from 1857 to 1904 in the semi-independent native states of Basutoland, between Natal and the Orange Free State, and Barotseland, now included in Northwest Rhodesia. Neither of these states had been reached by the *Pax Britannica* at the time of Coillard's arrival. The story of his work is that of patient endeavor for peace and reconciliation between natives and whites, and to it was due in large measure the ease with which British control was extended to the territory within which he had established his missions.

Mr. Rayne pictures with delightful humor his life as a British District Commissioner at Zeila, a port on the coast of British Somaliland which had passed through the vicissitudes of Arab and Egyptian occupation and exploitation before the advent of the British. Cattle raising is practically the only industry of Somaliland. With the proceeds the Somal buys from all parts of the world, the commodities reaching him mostly through Aden, the great clearing house of the East. Pearl fishing forms a minor industry. The Somal looks upon the British Commissioner as appointed for his particular use and proceeds to harass him, in season and out, with every imaginable grievance, trivial or otherwise. Hindu, Parsi, Mohammedan, Jew, and Christian live side by side in the commissioner's domain. His is the task of seeing that their relations bear somewhat the semblance of peace. Illuminating are the chapters on the Great War as it affected Somaliland, and of particular interest is the fact that the book closes with an account of the successful operations against Hassan Abdullah, the Mad Mullah.

Manfred Nathan, who is a member of the Transvaal Provincial Council, has made his book very much of a compendium of knowledge of South African life and affairs—racial, social, political, economic, educational. Some two hundred pages are devoted to a discussion of the origin, constitution, and political organization of the Commonwealth. The discussion is unusually good reading and is a pleasant departure from the customary lifeless method of presenting such information. The native problem, labor problems, the treatment of Asiatics, the industries, finances, education are treated in sympathetic fashion. Literature and science and their status in the Commonwealth are given separate chapters. The volume closes with a tribute to Louis Botha who died while the preceding chapters were in the press.

Irrigation and Cultivation in the Senegal Basin

Yves Henry. **Irrigations et cultures irriguées en Afrique tropicale.** v and 296 pp.; maps, diagrs., ills. Émile Larose, Paris, 1918. 12 frs. 10 x 6½ inches.

The report which M. Henry has published with the collaboration of M. J. Lemmet deals chiefly with the possibilities of agricultural production in the valley and delta of the

Senegal River in French West Africa. From the spirited preface by M. E. Tisserand to the closing paragraph the report breathes a strong note of optimism, and frequent comparisons are made between the valley of the Senegal and that of the Nile.

Irrigation in the region of the Senegal is largely a matter of the future. At present the production of rice and sorghum, the chief food crops, is scarcely sufficient to support the sparse native population of some 200,000.

The Senegal, a river nearly 1,000 miles long, rises in a range of low mountains southwest of Dakar, flowing thence northwest and west into the ocean at St. Louis. The Niger, which has its source on the southern slope of the same range, flows a long way eastward before turning south and west. The Senegal is a sluggish stream when not in flood, its mean low-water gradient for nearly 600 miles above the mouth being about 2 inches per mile. Thus it is salty during low stage for 100 miles up stream.

The irrigable lands are composed of a blanket of silt deposited from the flood waters and of low relief. Like the valley of the Nile this silt blanket is underlain by ground water when not submerged. Much of the soil, particularly in the lower delta, is heavily charged with salt and when dry is often hard and slowly permeable to water.

M. Henry has brought together in his report a valuable collection of facts concerning the character of the soil, and the period and height of the flood discharge of the river. It is to be regretted that he has not included data from which the volume of discharge could be computed as well as facts concerning the salt content and the silt load of the stream.

The data on rainfall are comprehensive and cover a long period, but temperature data are wanting. For those who seek to support the hypothesis that deforestation causes decreased rainfall this report will be a welcome contribution.

The present agriculture of the region is described concisely, and the essentials for future development are boldly outlined. Detailed plans are suggested for control measures by which certain areas of the delta could be utilized more effectively, particularly the basin of the Lac de Guier, a basin tributary to the river about one hundred miles above its mouth.

The essential features of the proposed development are to prevent further salting of this basin by sea water and to regulate access of river flood water. The flood period extends from August to November. For the future the agricultural industries most emphasized are the production of cotton and dâ (*Hibiscus cannabinus* L.). The latter plant, which yields a soft fiberlike jute, is now produced by the Senegalese chiefly for local use. The present account of the plant and its production by the natives is a valuable contribution to the literature of fiber plants.

C. S. Scofield

Tropical Forests and Their Resources in French Colonies

A. Bertin. Vol. 1. **Les bois de la Côte d'Ivoire.** 176 pp.; map, ills.; Vol. 2, **Les bois du Gabon.** 304 pp.; map, ills.; Vol. 3, **La question forestière coloniale.** xx and 833 pp.; maps, diagrs., ills.; Vol. 4, **Les bois du Cameroun.** 312 pp.; maps, diagrs., ills.; Vol. 5, **Les bois de la guyane française et du Brésil.** vi and 318 pp.; map, diagrs., ills. Mission d'Études forestières envoyée dans les colonies françaises par les ministères de la guerre, de l'armement et des colonies. Émil Larose, Paris, 1918–1920. 10 x 6½ inches.

This work describes the results of an official investigation of the forest resources of certain of the French colonies. Four of the volumes are devoted to detailed accounts of the economically important trees of the Ivory Coast (Vol. 1), Gabon (Vol. 2), Cameroons (Vol. 4), and French Guiana (Vol. 5), the last volume containing also an appendix on the timbers of Brazil. Volume 3, entitled "The colonial forestry problem" (La question forestière coloniale) is of more general interest both from the economic and from the phytogeographical point of view. The first part of this volume discusses the forestry situation in France, especially as affected by the war, and the necessity of drawing upon the colonial forests to supplement the home-grown supply of timber.

The second part of Volume 3 deals with the tropical forests of French West Africa, taking up in succession the Ivory Coast, Gabon, and Cameroons and describing briefly the physical geography of the forested regions, geology, human population, labor available for forest work, administrative organization of the colony, and means of transportation. There follows

an account of the general aspect of the equatorial African forest, a technical description of the timber resources, and a discussion of the botanical relationships of the trees.

Part 3 is devoted to methods of exploitation, and Part 4 to the sylviculture and management of the colonial forests. In Part 5 the technological classification of colonial timbers is treated, and Part 6 presents the conclusions of the mission regarding the utilization of the colonial forests.

It will be inferred from the foregoing abstract of its contents that this book is primarily of interest to foresters and persons having a manufacturing or commercial interest in tropical forest products. This follows from the definitely economic object of the mission and the circumstances under which it was organized. Professional geographers will turn to other sources for information concerning these colonies, although the student of plant geography will find in the second part of Volume 3 data on the botanical composition of the forests of tropical West Africa.

T. H. KEARNEY

THE COAST AND ISLANDS OF FORMER GERMAN EAST AFRICA

EMIL WERTH. **Das Deutsch-Ostafrikanische Küstenland und die vorgelagerten Inseln.** Vol. 1, xvi and 334 pp.; map, diagrs., ills., bibliogr.: Vol. 2, vii and 265 pp.; maps, ills., index. Dietrich Reimer (Ernst Vohsen), Berlin, 1915. 10 x 7 inches.

This valuable work, describing the coast of the late German East Africa with its length of nearly 500 miles and its three large offshore islands, is based on the author's own observations, which continued over a number of years, and is extended by selections from studies of others. One of the chapters is analyzed below. The half-tone plates are good as a rule; the text figures are mediocre or poor; a bibliography of some thirty titles, some of them rather irrelevant, is given near the beginning of the first volume; the index at the end of the second is exceptionally full. There are no page headings, and the modern style of Roman type from which the book is printed is unattractive. The accompanying maps are of high value. Two are on a scale of 1:500,000, with flowing 50-meter contours, one of these showing the geology in nine colors; the other, in six colors, shows the distribution of vegetation, which seems to be closely related to the geology. A third map, on a scale of 1:2,000,000, exhibits the distribution of native culture. The plan of treatment is as follows. The first volume is occupied with a systematic account of various topics beginning with the near-shore sea (12 pp.); then come the structure and form of the coastal belt, from 20 to 40 miles wide, and of the large islands of Pemba, Zanzibar, and Mafia (88 pp.); next the climate (37 pp.), flora (57 pp.), and fauna (39 pp.); and finally the native tribes (152 pp.) and products and trade (75 pp.). The second volume is occupied with descriptions of six physiographic districts and their subdivisions, in which the topics that were separately treated in the first volume are presented in their natural relations; but the enchainment of the different topics is not brought out here so emphatically as one might wish.

The author shows himself to be broadly familiar with many subjects and sets forth much information in technical form that must be interesting to specialists in various sciences; but if the other chapters are not handled more skillfully than the chapter on geological structure and topographic form, here reviewed in some detail, they will be disappointing, even if instructive, to their readers. That chapter attempts to give a genetic account of the land forms, but the attempt is not altogether successful because the reader has to plow through too much explanatory argument before he reaches the things explained; and the plowing is sometimes difficult by reason of the involved construction of subordinate clauses. In some respects the sequence of treatment is unsatisfactory: for example, before the general features of structure and form are presented, the displacement of certain supposed fault blocks is described on a purely topographic basis but with no mention of post-faulting erosion; the reader can form no independent judgment here until after he has read later pages, and not easily then. The manner of treatment also is unsatisfactory in several sections because it does not clearly enough recognize that every structural mass has a changing surface form and that the reader cannot acquire an understanding of the districts concerned unless the present phase of changing surface form, as well as the more constant underground structure of each mass, is explicitly stated. Sometimes important details concerning structure are wanting, as in an account of the backland, where the occurrence of Jurassic and Cretaceous formations is noted but without indication of the thickness or attitude of their strata.

An overeasy acceptance of hypothetical displacements, above implied, is again seen in a brief account of coastal trends, which are ascribed in part to faulting; though it may well be believed that a true-scale section would show moderate flexures to be sufficient. Unfortunately, few sections are given, those few are grossly exaggerated vertically, and only one of them indicates underground structure; the others are drawn in solid black. Some of these, which by an entirely permissible reduction might be shortened to the breadth of a page so as to stand in proper attitude, have to be turned lengthwise along the page side, as a result of which their locality names are actually printed upside-down! The lack of carefully drawn structural sections seriously delays the understanding of the text; but the following physiographic relations appear to be indicated.

A hilly or mountainous backland, composed of gneiss, slates, and other rocks, and here and there reaching altitudes of from 600 to 1,000 meters at a distance of 20 or 30 miles from the sea, is unconformably blanketed in its lower areas with a heavy body of strata, sandy inland where their altitude is 200 or 300 meters and declining toward the coast where they become in part calcareous. Their surface is submaturely dissected by branching valleys, and the valleys are occupied up to 50 or 100 meters by a later series of sandy and loamy deposits which become confluent near the shore where they constitute a young coastal plain that is margined along the more advanced parts of the coast by a raised and clift coral reef 25 meters in altitude. A level limestone bench extends inland from the raised reef for an unspecified but apparently moderate distance and ends at an abrupt step which rises some 20 or 30 meters to the main area of the plain. The step and the bench in front of it are ascribed to former marine abrasion and correspond to similar features along the advanced shore of today. The inland branches of the coastal plain, which occupy the valleys of the uplands as above stated, are themselves as well as the forward part of the plain trenched by younger and narrower valleys, which are floored with flood plains, good for cotton culture, all the way to their mouths where the margin of the plain, retreating in two long bights, is cut back in sloping bluffs and fronted by shallow water; but where the margin of the plain advances in clift-reef headlands toward deep water between the two long, shallow bights, the valleys are entered by narrow salt-water embayments, which serve as excellent harbors. Beneath the clift-reef headlands of the advanced coast the deep-water shore is bordered by a well developed fringing reef, from half a mile to a mile wide; the shallow-water shores of the bights and the embayments are often bordered by mangrove swamps.

The coastal region, therefore, exhibits the records of three emergences and of as many submergences; the last submergence is thought, on rather insufficient grounds, to be still in progress. The elevated reef is one of the records of the second submergence; the sea-level fringing reef of the third. One of these widespread movements, perhaps the third one which is recorded by the emergence of the advanced headlands, seems to be responsible also for a down-warping of the coast in the two long shallow bights just mentioned. The longer bight is in the northern half of the colony and has a chord length of 150 miles; it is occupied near its middle by the 50-by-20-mile island of Zanzibar, which consists of mainland strata in its western half and of uplifted reef limestones in its eastern half and which shows along its eastern side two-level abrasional features like those of the advanced mainland coast. The second bight is in the southern part of the coast and has a chord length of 120 miles; it is occupied near its middle by the 30-by-10-mile island of Mafia, which is rimmed on its outer side by a much narrower elevated reef than that of Zanzibar. Behind this island the bight is narrowed and shoaled by the advancing delta of the Rufiji, one of the largest rivers of the region; its numerous distributaries have lengths up to 30 miles, and the delta has a still longer sea front. Both bights are beset by many reef patches with occasional islets.

The advanced clift-reef coast occupies three stretches, outside of which a rapid descent is made to deep water. The northern stretch, continued from British East Africa, is 70 miles in length and is partly fronted by a discontinuous barrier reef, offshore from which lies the 40-by-20-mile island of Pemba, with an outer border of raised reef in simple outline and a minutely embayed inner border; between the island and the continent is a reef-free, deep-water passage, 30 miles in width. As Pemba, like Zanzibar, contains some mainland strata back of its elevated reef, the deep-water passage may be plausibly ascribed to down-flexing or down-faulting. Another stretch of advanced coast, 140 miles in length, lies in the south and continues into Portuguese East Africa; several of its embayments near the German boundary are associated with sharp inturns of the 200-meter submarine contour; close to the boundary the Rovuma, about as large a river as the Rufiji, still has an estuarine mouth. The third advanced coastal stretch separates the two bights and is only 30 miles in

length; near its northern end Dar-es-Salaam, the chief port of the coast, lies on a fine harbor embayment; the town of Zanzibar, not far away to the north, has a reef-enclosed harbor on the western side of its island.

The fivefold division of the coast, just described, is the most profitable physiographic lesson of Werth's book. It is given belated statement in the first part of the second volume. The above explanation of it by down-warping in association with the emergence of the elevated reef, as well as the changes of level inferred from the sandy and loamy deposits which occupy the valleys of the uplands and which are themselves trenched by narrower and partly embayed valleys, are based more on the geological map than on the text; but the map indicates them so clearly that the absence or obscurity of text statements concerning them is not easily understood. On the other hand, a redundant treatment of the abrasional features along the advanced coast is also difficult to understand; they are described first under "Küstenterrassen" on pages 22 to 24 and again under "Strandterrassen" on pages 49 to 51. One bite at that sort of a cherry should suffice. But there is, without question, a large body of physiographic information contained in the two volumes; and if the other chapters are as richly stored as the one here reviewed they are well worth working.

The book appears to have been prepared about the time the World War began and was published during its progress. It is dedicated to those who had already lost their lives in defending German possessions in East Africa. The coastal belt was selected for description because of its great importance in the further development of the colony. The many pages must, therefore, be sad reading to German readers under present conditions; but they must be of high value to the mandatary in whose charge the colony has been placed.

W. M. Davis

Dunes and Dune Formation

W. Behrmann. **Borkum: Strand- und Dünenstudien.** 40 pp.; map, ills. *Meereskunde No. 153* (= Vol. 13, 1919, No. 9). Berlin.

Borkum, a well known bathing resort, situated at the mouth of the Ems, nine miles from the Dutch coast and between the channels called the Oster Ems and Wester Ems, is the westernmost of the East Frisian Islands. The island has grown together from two islands, which are even now so clearly indicated that they bear the distinctive names of Eastland and Westland. The small Eastland lies north of the larger Westland and is not so greatly exposed to the winds and waves as the latter. The islands were separated from each other from time to time up to 1863. Since then they have been joined by a dike, and the dunes on the north have been made artificially and ingeniously for the reinforcement of this dike. At some time sand comes to the island from all sides except the east, where there is a sand-clay flat. The waves and the tides tend to beat and to scour material from the west end and to drive it toward or to this sand-clay flat. But there are high dunes on the west and also a beach wall almost four kilometers long which protects the land from the violent beating of the waves. Before this wall was built the breakers had already reached the dunes; and there is a steady westward movement of the sands along shore which has formed and maintains the "Hohe Hörn." This movement of the sand of Borkum is like that of all the Frisian Islands, to the east. The Eastland, however, is not so strongly swept and scoured by the winds, waves, and tides as the Westland. The sand level on the North Strand is wonderfully maintained through the protective effect of the great horseshoe-shaped dune which covers a large part of Eastland.

The author discusses in detail the formation of rill- and ripple-marks on the beach, as well as the deeper channels that occur in front of the breakers; and he describes the occurrence of beach potholes, made by the fall of the stronger breakers, and the formation and breaching of beach walls. The incoming waves and tides normally bring in much more material to the shore than is carried away by the ebb, and in this way a beach wall 80 to 100 meters broad and 1½ meters high has been built up between the beach flats and the sea. The beach flats are growing in the east and breaking down in the west. One may observe on a portion of Borkum the base level due to deflation, and every phase of the work of wind and wave is here observed and described.

"The side on which the wind allows plants to grow promotes upbuilding and encourages animal and human life. The fowl world of the inner side is entirely different from that on

the side exposed to the open sea. In the meadows struts the plover, the lapwing cries, and the crested lark rejoices; the beach bird shows himself only on stormy days, and in the protection of the dune. . . . The inhabitants use driftwood for fuel and building. Close by or between the dunes in the vicinity of the sea lie the little houses of the fishermen." The paper is a study of shore-line processes in relation to biogeography.

COLLIER COBB

ÉDOUARD HARLE AND JACQUES HARLÉ. **Memoir sur les dunes de Gascogne, avec observations sur la formation des dunes.** Extrait du *Bulletin de la Section de Géographie, 1919*, pp. 145. Paris, 1920.

The senior author of this interesting paper has previously published nine papers on different phases of the geology or geography of Gascony, one of which, "La fixation des dunes de Gascogne," was noticed in the *Geographical Review* for November, 1916. The two authors, father and son, have previously published, in collaboration, "Les dunes continentales des landes de Gascogne" and "Les dunes maritimes de la côte de Gascogne."

The dunes of Gascony, those of the interior as well as those that border the ocean, are very numerous, and those along the coast are the most considerable in Europe. Save for some very rare exceptions, those next the ocean are all covered with forests which are completely fixed. One rarely sees these dunes actually move, and many of the authors' conclusions are therefore deductions drawn from what has been told them about the now immovable dunes. The studies in each case deal with observations that have actually been made by someone up to this time. In certain cases the authors give no explanations of the observed phenomena, and in others they express doubt as to the explanations that they do give. The hope is expressed that even if what is set forth is incomplete and lacking in clearness, it will serve "to provoke someone to more careful study."

The account is illustrated with numerous plans and sketches which make clear the authors' explanations and give one an excellent idea of the country.

The paper then proceeds to a geological description of the country, which much resembles our own Atlantic coastal plain. The origin of the sands of the *landes*, that is their source and manner of transportation, is very obscure; but the author is inclined to accept the view expressed by Glayac that the sands have been brought from the land by the rivers, which have wandered much in their courses over the plain, and have been thrown up from the sea by the waves and driven inward by the winds. He objects to this explanation, however, on the ground that the material is very fine, and he would expect the river to bring down stones of considerable size, and the waves of the sea to throw up something of the same sort. The Garonne and Adour actually do transport fair-sized stones, and the sea is now actually depositing stones of some size on the borders of the *landes*.

An excellent and somewhat detailed description of the surface of the district is given, with some account of the agglomerated sand, known locally as *alios*, a hardpan which exerts a marked influence on the drainage and water table of the district.

Unlike previous studies of the region, this paper treats not only of the maritime dunes, but of the continental dunes as well, dividing these latter into dunes of the plateaus and dunes of the valleys. The authors here present a most interesting discussion of the origin of the parabolic dunes, where the wind has hollowed out the concave side. They have moved in a direction exactly opposite to that of the wind, which has formed and is now driving forward the *medanos* or *barchanes* in our own interior, or the whale heads on Currituck. The authors show one such form (termed *caoudeyre*) from the commune of Pissos, in which the hollowing is done by the wind moving in the direction of the horns of the crescent. These parabolic dunes owe their form to the erosive action of the wind, and in this they differ essentially from *barchanes*, which are due to constructive action, and these latter are evidently unknown to our authors in their district.

The *étangs*, lakes formed by dune action hindering drainage, are described, and the later formation of dunes on the shores of these lakes is indicated.

The sands composing the dunes, the differences between the ancient and the modern dunes, and the changes in the forms of the modern dunes produced by fixation, are all considered with much care.

The movement of dunes in waves, a phenomenon well-marked on our own Atlantic coast, is here noted, and the last section of the brochure is devoted to a discussion of the theory of such movements.

The bibliography is good but needs some additions. A detailed index would add to the usefulness of the paper. This paper, together with the account of the Borkum dunes, may well be taken as a model for future studies of dune areas.

COLLIER COBB

A TEXTBOOK OF SEISMOLOGY

CHARLES DAVISON. **A Manual of Seismology.** xi and 256 pp.; maps, diagrs., ills., index. (Cambridge Geological Ser.) The University Press, Cambridge, 1921. 8½ x 6 inches.

Dr. Davison's contributions to the study of earthquakes are well known, and we welcome this volume from him. His "aim has been to give an outline of our present knowledge" of the subject; and this he has accomplished very well. He has given clear accounts of the principle of seismographs, of the nature of earthquake motion, of the propagation of the disturbance, of the geographical distribution of earthquakes—in short, of earthquake phenomena in general. Students of seismology will miss a discussion of the underlying principles of the subject and of its many still unsettled problems; but the length of the book and the general purpose of the series to which it belongs make this impossible. A few ideas are expressed with which the reviewer does not agree; for instance, Davison's conceptions of twin earthquakes. He supposes two fractures of the rock, at points not far apart, to take place within an interval of time so short that the second fracture could not be influenced by the vibrations from the first. Much stronger evidence than we have is necessary to establish so improbable a coincidence. In common with some other seismologists he thinks the buckling of railroad lines in Baluchistan at the time of the earthquake in 1892 indicated a compression of the earth's crust; whereas it was shown in the report of the California earthquake of 1906 that the movement on the fault caused just such an apparent compression without any reduction of the area of the region. Davison regards the first appearance of seismic sea waves at the shore as a depression of the water; this is certainly very general, but there are many instances where the elevation of the water occurs first. The destructive effects of earthquakes on houses and other structures are not treated, probably for lack of space and because these effects may be considered as belonging to applied seismology rather than to the pure science itself.

HARRY FIELDING REID

A NEW ESTIMATE OF OCEAN DEPTHS

ERWIN KOSSINNA. **Die Tiefen des Weltmeeres.** 70 pp.; diagrs. *Veroffentl. des Inst. für Meereskunde*, N. F., A. (Geographisch-naturwissenschaftliche Reihe), Heft 9. E. S. Mittler & Son, Berlin, 1921. 10½ x 7 inches.

This is the latest of the many attempts to estimate the mean depth of the ocean. There are no new methods devised, but the work has evidently been very painstaking, and the results are probably very near the truth. Groll's equivalent-area maps of the oceans, corrected by additional observations made since they appeared, are the basis of the work. The method used was to print Groll's bathymetric lines on paper ruled to square millimeters, and to count the number of square millimeters between successive lines, estimating to tenths. This was done for areas 5° on the side, over all the oceans, and checked by counting the millimeters in each area as a whole. The area corresponding to one square millimeter was not determined by the scale of the map, but by dividing the area between the bounding parallels and meridians, as calculated on a Bessel's spheroid, by the total number of square millimeters counted in it. By this means errors due to inaccuracies in ruling the paper, or to shrinkage or expansion, were avoided. The errors that could not be avoided are due to inaccuracies of the maps and to lack of data for even large areas of the oceans, but it is not likely that Kossinna's results will be materially affected when these deficiencies are made up. The mean depth that he deduces for all the oceans is 3,800 ± 100 meters, somewhat greater than the best estimates made earlier. His measures can evidently be used for other purposes; for instance, to determine the ratio of land and water on the globe. This he finds to be 1 : 2.43; agreeing with Krümmel and differing somewhat from Wagner (1 : 2.54). He also applies his measures to find the ratio of land to water in the northern and southern, the land and the water, hemispheres, and to determine the areas and mean depths of all the oceans and seas of the earth. He combines with

his own measures the estimates of the mean heights of the continents and islands, given by other investigators, to draw a hypsometric curve, and to deduce the mean level of the solid crust, which he finds to be 2,440 meters below sea level. The paper is full of tables giving much information of the kind mentioned above and will be very useful to those interested in this line of earth science.

HARRY FIELDING REID

A MANUAL OF MAP PROJECTION

C. H. DEETZ AND O. S. ADAMS. **Elements of Map Projection with Applications to Map and Chart Construction.** 163 pp.; maps, diagrs., index. *U. S. Coast and Geodetic Survey Special Publ. No. 68*, Washington, D. C., 1921. 50 cents. 11½ x 7½ inches.

This is, primarily, a working manual on map projections. Part I deals with the theory involved in representing a curved surface on a plane and explains in simple language the underlying principles of several of the more common projections. Part II deals with the practical construction of these projections and includes detailed instructions as well as the necessary tables, in most cases. The mathematical development of a few of the projections is given for the benefit of those who may wish to see how the formulae are derived; but otherwise the entire book is of an elementary nature and does not require a knowledge of higher mathematics for a full appreciation of its contents.

In Part II the following projections are treated in separate chapters: Polyconic, Bonne, Lambert zenithal equal-area, Lambert conformal conic, Albers conical equal-area, Mercator, and gnomonic. In addition, there is a chapter on world maps where various other projections are treated including the stereographic, Aitoff equal-area, Mollweide homalographic, Goode's homalographic (interrupted), Guyou's doubly periodic, and others. A comparison of several of these projections as regards the amount and location of the maximum distortion shown by illustration in the frontispiece.

The chapter on the polyconic projection includes a discussion of the transverse polyconic projection and the polyconic projection with two standard meridians as used for the International map of the world (tables for the polyconic projection are given in *U. S. Coast and Geodetic Survey Special Publication No. 5*).

Considerable interest attaches to the chapter on the Lambert conformal conic projection on account of the uses made of this projection during the World War. For a small country like France the projection is an ideal one on which to superimpose a grid or quadrillage system. For larger countries, such as the United States, the distortion of this projection becomes too great for military purposes, and some other projection or device must be used. The solution of this problem for the United States is explained in the chapter entitled "The Grid System of Military Mapping."

In many ways the best projection for a general base map of the United States or other large countries with a predominating east and west dimension, is the Albers conical equal-area projection, on account of the small scale distortion and because of other desirable properties. As explained in the chapter on this projection, it is very easy to construct, requiring only good judgment in the selection of the standard parallels.

Navigators will be especially interested in the chapter on the Mercator projection which includes Mercator tables. Considering the extensive use of this projection for charts, it deserves to be better understood and appreciated than is the case at present. The chapter on the gnomonic projection will also appeal to navigators on account of the special properties of this projection, which make it so useful as an adjunct to certain sailing charts and for charts on which to plot radio-compass bearings.

C. H. SWICK

DANISH RAINFALL MAPS

KURT LEHMANN-TEGEL. **Regenkarten des Königreichs Dänemark.** 26 pp.; maps, diagrs., bibliogr. Dietrich Reimer (Ernst Vohsen), Berlin, 1919. M. 6. 12¼ x 9¼ inches.

Denmark is a small country, but with its irregular coast line, its numerous bays and peninsulas, and its outlying islands it presents, within a limited area, a considerable variety of climatic conditions. The new rainfall maps are based on observations at about 200 stations. The basic period is 1876–1915. Reductions to the uniform period, together with certain interpolations, have been made. The isohyets on the mean annual map are

drawn for 50-millimeter intervals, except that in districts of less than 550 millimeters of rainfall no isohyets are drawn. The scale of this map is 1 : 1,000,000. Topography is not indicated. The heaviest rainfall occurs in the western portion of the peninsula and is shown to be 750–800 millimeters (about 30 inches). Topography is, in these cases, an obvious control. In the southern part of Jutland three west-east rainfall zones may be distinguished. The first, on the west coast, has dominant general storm rains. The second, inland, receives its rainfall from barometric depressions as well as from summer thunderstorms, the latter predominating, while the former become less and less important toward the east. The third zone, on the east coast, has a further decrease of general storm rains and also a decrease of thunderstorm rains. It is an interesting fact that these changes in the type of rainfall occur over so limited an area. A decrease in rainfall towards the north is also shown. The smallest amounts are slightly less than 20 inches, i.e. roughly equivalent to the mean annual rainfall along the 100th meridian in the United States.

The twelve monthly maps are on a scale of 3 : 1,000,000, with isohyets for every 10 millimeters. August is the rainiest month for most of Denmark. October brings a secondary maximum. Continental and marine tendencies are thus both indicated. Autumn rains are characteristic of the west coast. The August maximum is found over the interior.

R. DeC. WARD

A BIOGRAPHY OF DE SAUSSURE

D. W. FRESHFIELD. **The Life of Horace Benedict de Saussure.** xii and 479 pp.; maps, ills., bibliogr., index. Edward Arnold, London. 1920. 9½ x 6½ inches.

It seems somewhat surprising that over a century and a quarter should elapse after the death of De Saussure before his life was made the subject of an adequate biography. The name of De Saussure is intimately associated with two of the mightiest of the many intellectual and spiritual movements that had their origins during the closing years of the eighteenth century. One of these was that awakening love of nature and of mountains to which the romanticists gave expression in literature and in art and which has placed mountaineering in the foremost place not only among athletic sports but among recreations of the human spirit. The other was a movement in the realm of science away from the excessive theorizing and deductive reasoning that characterized eighteenth-century thought. It was a movement leading towards the work of men like Humboldt and Darwin, who founded their theories upon close observation of a multitude of facts. Humboldt was inspired to imitate the method of De Saussure whom he regarded as his master, and it "was the perusal of Humboldt's works which awoke in the young Charles Darwin the passion for travel and discovery" (p. 440).

At last justice has been done to the memory of De Saussure in the ample biography before us. By availing himself of the results of recent researches made by Mr. Henry F. Montagnier in the libraries and private archives of Geneva, Mr. Freshfield found at his disposal a wealth of hitherto unpublished material on De Saussure's career. The information obtained from these sources was supplemented by wide studies of the Genevan professor's scientific, literary, and political contemporaries, and the whole account is delightfully presented in a dignified and restrained, but vivid, English style. Indeed the book does far more than tell us of De Saussure. It introduces us to the leading figures of a critical period in the development of science and of mountaineering and gives us an intimate view of normal life in a refined intellectual and social circle of French-speaking Europe on the threshold of the French Revolution. By no means the least important part of Mr. Freshfield's biography are the pages devoted to Genevan politics during the last years of independence, the menace of the ideas that led to the great revolution in France, the final absorption of Geneva by France, and De Saussure's connection with these events.

De Saussure's fame, however, rests primarily upon his Alpine expeditions and upon researches in geology and meteorology. An illuminating chapter on the beginnings of interest in mountains and mountaineering enables us to estimate the importance of De Saussure's work in this respect. The claim has often been made that to Rousseau should be attributed the credit of arousing the mountaineering enthusiasm and appreciation of mountain landscapes that have become so characteristic of modern life. This claim Mr. Freshfield believes to be essentially false: Rousseau, who never even climbed a mountain and least of all ventured into regions of glacier and *névé*, was a lover and interpreter of the more placid scenery of lowland and foothill. If to any one individual belongs the

greater share of credit for having revealed the world of crags and ice it is to De Saussure. By offering a prize to the first man who should scale Mont Blanc, De Saussure urged the peasants of Chamonix to hazardous ventures ultimately crowned by success when Jacques Balmat reached the summit in August, 1786. After many attempts and delays, De Saussure himself achieved the ascent with a large party of guides the next year. This exploit created a prodigious sensation throughout Europe and is the feat for which De Saussure even now is most widely remembered, though more difficult and deserving of even higher praise was his long sojourn on the Col de Géant (1788) where he remained at an altitude of nearly 11,000 feet for over a fortnight carrying out meteorological observations.

Though De Saussure undeniably did much to open the way to future Alpinists, the main motives which induced him to undertake journeys in the Alps were neither a love of landscape nor a love of adventure. Before all else a scientist and geologist (he was the first to use the term *geology* in its modern sense), De Saussure was induced to explore mountains because he felt that they reveal far more advantageously than lowlands the structure of the earth and atmosphere and the "great processes of world-building" (p. 433).

The concrete results of his observations are too numerous to indicate here: indeed they were so numerous that Mr. Freshfield himself could but refer to them in a summary manner. In the field of geology his investigations led him among the first to an understanding of the succession of formations outward from the central core of a mountain range; in that of meteorology he invented many ingenious instruments and carried out extensive instrumental observations and experiments; his study of glaciers unfortunately yielded the least valuable results of his many researches.

The lasting scientific value of De Saussure's labors lay less in the originality of his theories than in the multitude of facts which he observed and the accuracy of his observations. He was criticized by contemporaries (possibly with some slight justification) for his hesitancy to theorize. It should be remembered, however, that death cut him short at the age of fifty-four when his life work was still unfinished and that at the time of his death he had in mind the composition of a great "Theory of the Earth" based upon his earlier work. It is to his lasting credit that he stood out valiantly against the often fantastically theoretical thought of his time.